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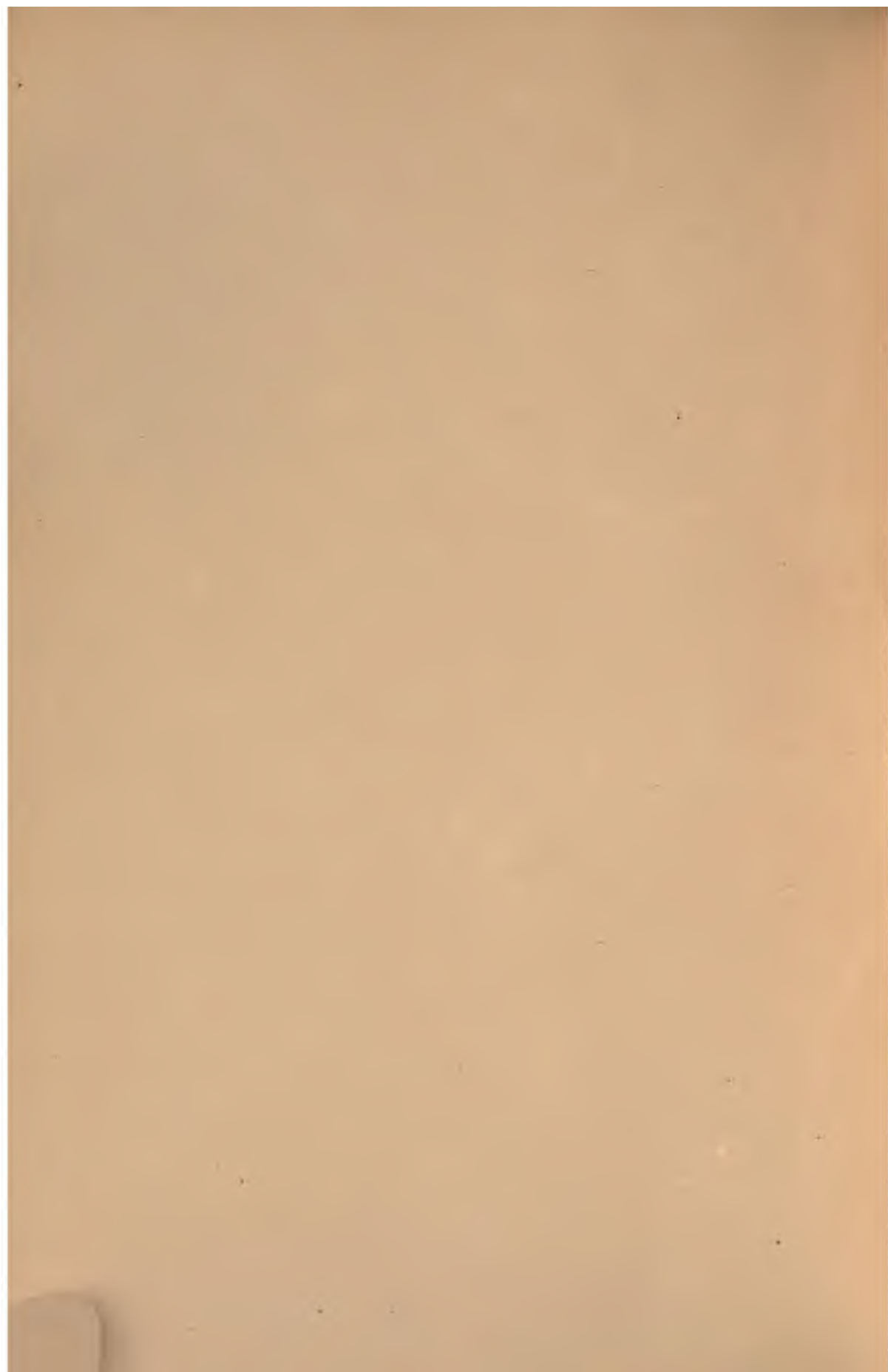
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A TEXT-BOOK
of
DISEASES OF WOMEN

BY
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***372 TEXT-ILLUSTRATIONS
AND 10 COLORED PLATES***

PHILADELPHIA AND LONDON
W. B. SAUNDERS COMPANY

1907

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PRINTED IN PHILADELPHIA

VOYAGE

TO
A. L. W.

PREFACE

IN preparing this volume the author has endeavored to keep constantly before him the following aims:

1. To give prominence to the scientific basis of each subject under consideration. For this purpose the most thorough attention has been given to modern researches in sectional and dissectional anatomy, histology, embryology, comparative anatomy, pathology, and bacteriology, in so far as they bear on diseases of women, and the author has included the chief facts collected by himself in original investigations carried on during the past sixteen years.

2. To study clinical phenomena in their widest relationships.

3. To insist upon exercising caution in the adoption of therapeutic measures not yet thoroughly tested, especially of certain ones which have, in recent years, been recklessly advocated.

4. To give emphasis to methods which have proved satisfactory in the author's experience.

Owing to the marked surgical trend in gynecologic practice during the last twenty-five years a narrow specialism has been evolved which has resulted in the establishment of a school whose motto is Michelet's dogma—*Le bassin c'est la femme*, and whose remedial measures are limited to different forms of mechanical procedure—from passing a sound to extirpating the appendages.

Too strong a protest cannot be urged against the concentration of attention on the local pelvic condition without regard to wider physical and psychological relationships. Pascal has a chapter, in his famous book, entitled "Man's Disproportion." The term might justly be applied to the mechanical school of gynecologists, who have done so much harm by their failure to give to the various symptoms related to the pelvis their proper proportional values.

The accusation of the broad-minded physician that gynecologists tend to ignore many factors, other than those of pelvic origin, which are productive of neuropathies in women, is a well-merited one, and the majority of specialists must acknowledge its force. It must also be admitted that there is much truth in the counter-charge, brought by the specialist against general physicians and neurologists, of a narrow sciolism which fails to estimate the significance of local pelvic phenomena, either from reckless disregard of them or from inability to make satisfactory physical examination of the pelvis. Whatever be the deficiencies of the latter members of the profession it is certain that their enlightenment will come not from narrow specialists but from those who, in addition to being well-grounded in their own sphere of work, are capable of a wide range of thought and vision, and whose practice is

based upon extensive knowledge, broad culture, the scientific habit, and sound judgment.

The numerous illustrations have been chosen with special reference to their teaching value. They are mostly reproductions of original drawings made under the author's supervision by Mr. Parker, Miss Glenat, and Dr. Carl Wahrer, from material in the Presbyterian Hospital and the large Gynecological Museum of Rush Medical College.

The author's thanks are due to his colleagues, Drs. Keyes, Lynch, and Fehring, for their assistance in the correction of manuscripts and proofs.

Special acknowledgment of the generous and hearty coöperation of the publishers must also be made.

J. CLARENCE WEBSTER.

100 STATE ST., CHICAGO.

November, 1906.

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**A TEXT-BOOK
OF
DISEASES OF WOMEN**

WEBSTER

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CHAPTER I.

ANATOMY.

THE EXTERNAL GENITALS.

The external genitals (pudendum) occupy the pubic region of the pelvis, the term *vulva* being usually employed to designate them in a general sense. They consist of the following: *mons veneris*, *labia majora*, *labia minora*, *clitoris*, *vestibule*, *fourchet*. The hymen may also be included, but in this work it is described in connection with the *vagina*. The following account refers to the conditions found in the normal adult nullipara, unless otherwise stated.

The **mons veneris** is the thick, fatty prominence situated anterior to the pubes. It is covered with crisp, curly hair, the upper limit of which is a sharply defined transverse border. Occasionally the arrangement of the hair is met with as it is found in males, namely, extending up toward the umbilicus in a triangular shape.

The **labia majora** are two thick folds of skin continuous with the *mons veneris*, the latter being sometimes known as the anterior commissure of the *labia*, extending backward toward the perineum. Usually they thin out in their posterior parts, so that they are not raised above the level of the surrounding skin. The anterior margin of the perineum is called the *posterior commissure* of the *labia* or *fourchet*. Sometimes a distinct, transversely curved ridge is formed by the union.

On their outer surface they are covered with hair, which is scanty and short near the posterior ends. The inner surface is moist, and in nulliparæ somewhat resembles a mucous surface; in a parous woman it becomes more skin-like, but has no hair. In the skin are numerous sweat- and sebaceous glands. The subcutaneous tissue consists of a network of connective tissue, with abundant elastic fibers, corresponding to the **tunica dartos** in the male scrotum, in the meshes of which is a large quantity of fat. In the deepest portion is a rich plexus of veins communicating with those in the abdominal wall, with the vesical, vaginal, external hemorrhoidal, and the obturator veins.

The outer ends of the round ligaments blend with the tissue of the upper portions of the *labia*. Sometimes the persistent canal of Nuck extends into the upper end.

The **labia minora**, or **nymphæ**, are two small folds of skin internal to the upper parts of the labia majora, one on each side. They are moist and of a reddish tinge. Usually they do not project beyond the labia majora. When they do, the outer portions become brown in color. Anteriorly, they approach the middle line, and each divides into two parts. The upper halves blend to form a covering to the glans clitoridis—the prepuce; the lower blend at a sharp angle under the glans to form the frenum or suspensory ligament of the clitoris. Posteriorly, the labia usually spread out gradually and are lost in the



Fig. 1.—External genitals of a virgin. The labia are drawn apart.

layers of the chorium. They appear ovoid, oblong, and round in different sections.

In and near the prepuce are compound globular endings, consisting apparently of two single end-bulbs bound together. Whether these have any relation to the genital corpuscles found in the clitoris it is impossible to say.

(b) **Pacini's or Vater's Corpuscles**.—These are few in number, and are found in the upper parts of the labia. Besides the well-known single form, I have found double and triple forms. The double corpuscle consists of two single bodies, each of which has a central core surrounded by delicate concentric layers, both being enveloped in a common capsule made up of several concentric coats. In a few instances I have found that the individual corpuscles are separate

labia majora about half-way down the latter. Sometimes they extend backward as distinct structures, and form a well-marked ridge on the anterior margin of the perineum (frenum labiorum or fourchet). This condition is usually found in girls. The labia are covered with ordinary stratified epithelium.

In the erect posture the labia majora and minora lie almost parallel to the horizon. The inner surfaces of the former are in apposition when well developed and under ordinary conditions. The latter are always in apposition save when actually pulled apart.

Sebaceous glands are present, especially near the anterior ends. From these the smegma is formed which is found about the clitoris. I have also found sweat-glands. There are no mucous glands.

In the papillæ of the skin I have found the following nerve-endings:

(a) **Krause's End-bulbs**.—These are the most numerous in the labia minora. They are found in the papillæ of the skin and in the deepest

at one end, though bound together in a common sheath in most of their length. In the triple corpuscle two are within a common capsule; the third, a small one, being in the wall of one of the larger ones. In some corpuscles a single axis-cylinder, and in others a double one, is found.

(c) **Wagner-Meissner Touch-corpuscles.**—I have found a few scattered ones. Krause denies their presence. Those who have described large numbers have probably mistaken the ovoid or oblong sections of Krause's end-bulbs for them. Krause has referred to the poorly developed sense of touch in the labia minora. I have tested the tactile sense, and have found that the prepuce is more sensitive than the labia minora, and these more sensitive than the labia majora and mons veneris. By Weber's test, the shortest distance at which two points can be distinctly recognized is, on the prepuce, 1 cm.; on the labia minora, 1.25 cm.; on the labia majora, 4 cm.

(Carrard has described in hypertrophied nymphæ an end-organ like Ihlder's, found in certain birds. I believe this to be either a touch-corpuscle or an end-bulb, pathologically altered. I have been unable to distinguish it in the normal nymphæ.)

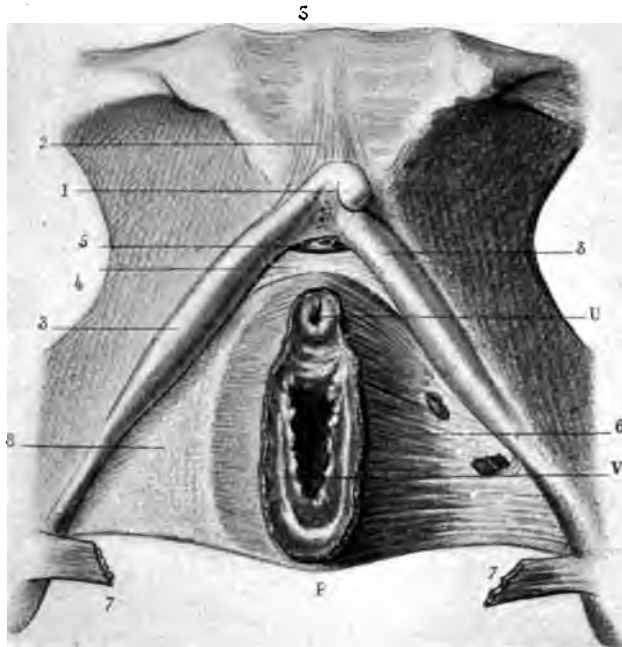


Fig. 2.—Dissection of anterior perineal region, seen from the front: 1, Clitoris; 3, 3, its crura; 4, subpubic ligament; 7, 7, superficial transverse muscle; 8, triangular ligament (anterior layer) (this is removed on left side) (Savage).

Note.—There are conflicting opinions as to the part played by the labia minora in the production of the sexual sense. If Krause be right in relating it to the special genital corpuscles first described by him, then, probably, the nymphæ serve no special sexual function. I have not found Krause's genital corpuscles in the nymphæ.

Variations According to Age.—In infants the labia majora are hairless, rounded folds of skin; the nymphæ are small. The mons veneris has no hair. At puberty hair grows on the mons veneris and labia and they increase in size. After the menopause the labia and mons veneris tend to atrophy, the hairs becoming scanty. The surfaces become smoother and paler and the vaginal opening smaller.

The Clitoris.—The clitoris, corresponding to the male penis, is situated in

front of the lower margin of the symphysis at the upper end of the labia minora, whose branched upper ends form its prepuce and frenum. It consists of two crura, body, and glans.

The *crura* are two in number, one on each side. Each is attached posteriorly to the bone formed by the blended descending pubic and ascending ischial rami. Thence they run upward, forward, and inward, and meet under the subpubic ligament to form the body of the clitoris. Each crus is covered with the ischiocavernosus muscle.

The *corpus clitoridis* in the erect condition is about three-fourths of an inch in length. It is not straight, but bent, so that a sharp concavity is on its under surface. It is made up of the two crura, consisting of cavernous tissue, bound in a fibrous capsule and with a septum between, which is perforated in several places. The fibrous capsule is continuous on the anterior part of the under surface with the frenum (suspensory ligament) by which the corpus is fastened to the lower anterior part of the symphysis pubis.

The *glans* is a small, acorn-shaped body, varying in dimensions up to the size of a pea, and situated at the anterior end of the corpus. It is not directly continuous with it, but is connected by the pars intermedia of the bulb. It corresponds to the glans penis in the male, but is not perforated by the urethra. On its under surface is a triangular space between the attachment of the two layers of the frenum. It is made up of cavernous tissue, its outer surface being covered with a thin layer of stratified epithelium.

The arteries of the clitoris are branches of the internal pudic. They run in the crura and become the dorsal arteries of the clitoris. The veins open into the pudic plexus; those of the glans open into the pars intermedia of the bulb.

In the glans clitoridis I have found the following nerve-endings:

1. *Wagner-Meissner corpuscles*, very few in number.
2. *Krause's end-bulbs*.
3. *Vater-Pacini corpuscles*. These are few in number, and are situated in each half of the posterior part of the glans, near the junction with the prepuce. They are mostly compound.
4. *Genital corpuscles of Krause*. These are found especially in two groups, one on each side of the middle line, especially abundant in the anterior part. They are irregularly rounded or oblong, forming several compartments, in which the terminal nerve-fibers lie. These vary in shape considerably, according to the planes in which sections are made.

The nerve-endings in the prepuce have already been described.

Note.—The clitoris is capable of becoming erect and hard; probably the mechanism by which this is brought about is similar to that found in the penis.

The ischiocavernosus muscle (erector clitoridis) of each side is inserted into a fascia, which envelops the posterior part of the corpus clitoridis. By this arrangement contraction of the muscles can cause a constriction which leads to a venous engorgement of the organ.

Development of the Clitoris.—At first the clitoris appears as a projection—the sexual eminence, at the anterior part of the urogenital sinus. During the first two months no prepuce can be distinguished. This is formed probably about the third month, as Hart has described, as follows:

A thimble-like involution of the epidermis occurs, the open base reaching what forms the corona of the glans. The central epithelial cells of the involution are less active, and desquamate, whereby a slit is left between the glans and the covering prepuce. If a coronal section be made through the sexual eminence at this stage, the epithelial involution appears sickle-shaped.

The Vestibule.—The vestibule is best described as the remains of the urogenital sinus. Its boundaries are as follows: in front, the clitoris; behind,

the fourchet; laterally, the labia minora. It contains the openings of the urethra, vagina, and the two ducts of the Bartholinian glands. (Some authors describe the vestibule as the smooth, red, triangular surface whose apex is formed by the frenum of the clitoris, base by the hymen, and sides by the labia minora.) In the middle line in front of the hymen lies the external orifice of the urethra. In the nullipara the slit of the urethral opening is triradiate in shape; on stretching the vestibule transversely the slit becomes transversely crescentic, the concavity looking backward. Between the orifice and the clitoris is some-

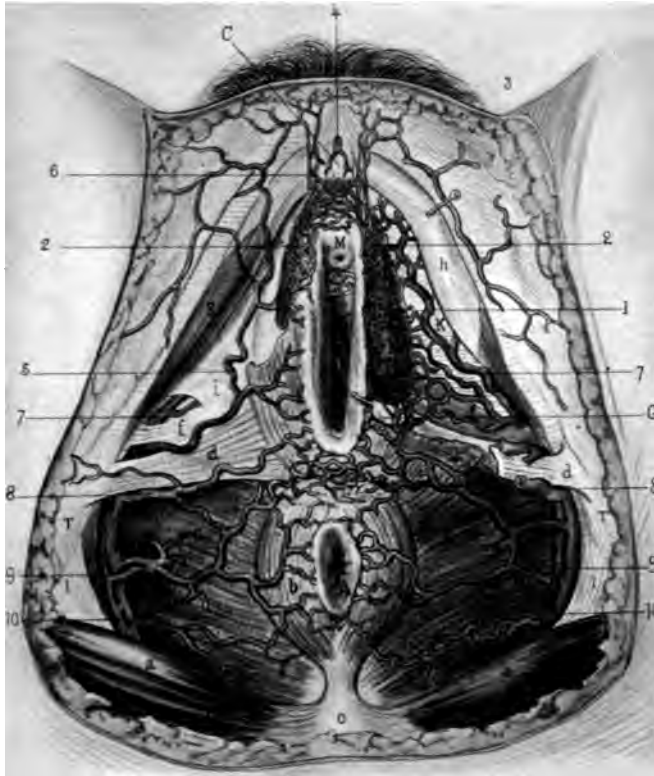


Fig. 3.—Superficial veins of perineum: *h, g*, Crura clitoridis; *c*, clitoris; *1, 2, 3*, corpus cavernosum urethræ (bulb of vagina); *g*, Bartholinian gland; *8, 9, 10*, pudic vein and primary branches forming the chief efferent veins of the bulb; *m*, urethra; *v*, vagina; *A*, anus; *T, T*, ischial tuberosities; *g*, erector clitoridis muscle; *d, d*, superficial perineal muscles (Savage).

times seen a slightly raised ridge, called by Pozzi the “male vestibular band.” It surrounds the orifice of the urethra, and passes into the hymen. Pozzi believes it to correspond to the anterior part of the corpus spongiosum, which surrounds the male urethra.

Several small depressions of various depths exist on each side between the urethra and the nymphæ; they are more noticeable in multiparæ.

Close to the hymen, behind the urethral orifice, a few small mucous glands are found.

The Corpus Cavernosum Urethræ.—This structure, consisting of erectile tissue, consists of a central and two lateral portions. It corresponds to the corpus spongiosum of the male penis.

The central portion, known as the *pars intermedia*, lies in front of the urethra, and anteriorly forms the connection between the glans and corpus clitoridis. It rests internally against the lower anterior margin of the symphysis, the vestibule being external to it. The lateral portions, known as the *vestibular bulbs*, are elongated, bean-like structures (3 to 5 cm. long, 1 to 5 cm. wide, 1 cm. thick), which lie, one on each side of the *introitus vaginæ*, in relation posteriorly with the anterior layer of the triangular ligament in the greater part of their extent; at their posterior extremities they partly cover the Bartholinian glands.

Considerable variations are found in the extent to which the spongy body is developed. Usually, the central portion becomes relatively less pronounced as the child grows older; generally, in adult life, it is not visible as a projection in the middle line of the vestibule. It varies also in the region of the urethral orifice and hymen. It surrounds the urethra, and may occasionally project somewhat into the hymen, making this structure very vascular.

The corpus cavernosum is erectile tissue, and is composed of tortuous, anastomosing blood-vessels in a framework of thin connective tissue. On section, it has a spongy appearance. Blood enters the bulbs at their posterior ends from branches of the pudic arteries, while the *pars intermedia* communicates with the arteries of the clitoris. The outlet veins are mainly at the posterior ends of the bulbs, communicating with the pudendal veins, the inferior hemorrhoidal, and the vaginal plexus; the anterior parts of the bulbs and the *pars intermedia* join the veins lying under the vestibule.

Under sexual excitement the corpus cavernosum enlarges, owing to congestion of its vessels. This is brought about, partly, by the constriction of the clitoris, caused by the contraction of the ischiocavernosus muscles, partly by the contraction of the bulbocavernosi (sphincter vaginæ). These latter cover the bulbs as they extend from the perineum forward to end in a fascia which embraces the corpus clitoridis.

The Bartholinian Glands.—These structures, two in number, corresponding to Cowper's glands in the male, vary in size from a pea to a bean; each lies lateral to the vaginal orifice, partly under cover of the posterior end of the bulb of the vagina, partly under the bulbocavernosus (sphincter vaginæ) muscle. In some cases they are entirely covered by the latter. Sometimes they are partly embedded in the spongy tissue of the bulbs. Posteriorly, they are in relation to the triangular ligament.

Each gland consists of a large number of divisions lying in a connective-tissue framework, containing some smooth muscle-fibers. Each division, lined with goblet-like, mucus-secreting cells, communicates with the main duct of the gland, which extends from the inner anterior margin forward to open on the inner margin of the labium minus close to the anterior third of the hymen. In the multipara the opening may be hard to find, owing to the irregularities of the *carunculæ myrtiformes*. The outer part of the wall of the duct consists of connective tissue with some nonstriped muscle.

It is lined in the greater part of its extent with cylindric epithelium; at the outer end, with stratified squamous epithelium.

Sometimes the gland is not a single mass, but consists of several separate portions. Sometimes it is entirely absent on one or both sides. Rarely, there may be two ducts on one side.

Note.—The secretion is clear, glairy mucus, and serves as a lubricator of the vestibule and adjacent parts. During sexual excitement it may be expelled suddenly by the muscular fibers in the gland stroma, as well as by the overlying bulbocavernosus muscle.

Development.—The Bartholinian glands are formed from a budding inward of the epithelium of the urogenital sinus. By the time the uterus and vagina are distinct from each other, it is quite formed, though of small size. Mucus is secreted at an early age.

THE INTERNAL GENITALS.

THE UTERUS.

The uterus is a body resembling somewhat in shape a flattened pear. When the organ is dissected from its attachments and viewed from the front or back, the upper end or fundus is the broadest part and is convex, the lower end or cervix being slightly conic and rounded. On each lateral wall is a depression, marking the junction of the corpus and cervix uteri; this part of the uterus is called the *isthmus*.

Viewed laterally, the posterior wall of the body is more rounded than the anterior; it has also a depression at the level of the isthmus. At the junction of the fundus and lateral walls the Fallopian tubes enter the body. Seen from below, the appearance of the cervix varies according to whether the woman has borne children or not. In a nullipara the os externum looks like a small rounded dimple; in a multipara it is a transverse slit, and somewhat irregular, owing to fissuring.

Component Parts.—In the normal adult nullipara the *corpus uteri* measures about * 2 inches in width at the fundus and about 1 inch at the isthmus. Its anteroposterior measurement is 1 inch. The vertical measurement from fundus to isthmus is 2 inches. From the isthmus to the os externum the length is 1 inch. Transversely the cervix measures about 1 inch in its widest portion.

In the parous woman the measurements are usually somewhat greater.

The vaginal uterus weighs from 40 to 50 gm., the parous uterus, 50 to 70 gm.

The average thickness of the wall of the uterus is half an inch, the posterior being slightly thicker than the anterior. The walls are in apposition or are separated by mucus secreted by them.

The cavity of the corpus uteri, as seen on sagittal mesial section, is a vertical slit, 1½ inches in length. On coronal section it is triangular in shape, the apex being at the *os internum*, the basal angles extending upward and outward toward the openings of the Fallopian tubes. On transverse section the cavity appears as a transverse slit.

The cervical portion of the cavity measures 1 inch in length. It is somewhat fusiform in its long axis, being narrowed at its upper and lower ends. The os externum measures transversely nearly a quarter of an inch; anteroposteriorly, slightly more. The cavity, in its widest or anteroposterior diameter, measures about $\frac{1}{8}$ inch, and in its transverse diameter slightly less than

*The measurements refer to the nullipara, unless otherwise stated.

$\frac{1}{4}$ inch. The os internum measures about $\frac{3}{16}$ inch in diameter. The diameter of the tube lumen at its junction with the cornu is about $\frac{1}{32}$ inch.

That part of the cervix lying in the vagina is known as the vaginal portion (*portio vaginalis*), the rest being the supravaginal portion.

Schroeder divides the cervix into three parts, according to the attachment of the vaginal walls. All above the level of attachment of the posterior vaginal wall is the *supravaginal* portion, that below the level of attachment of the anterior vaginal wall the *vaginal* portion, while the part between these is the *intermediate* portion.

It is usual to speak of that part of the vaginal portion in front of the os as the *anterior lip*, and of the rest as the *posterior lip*.

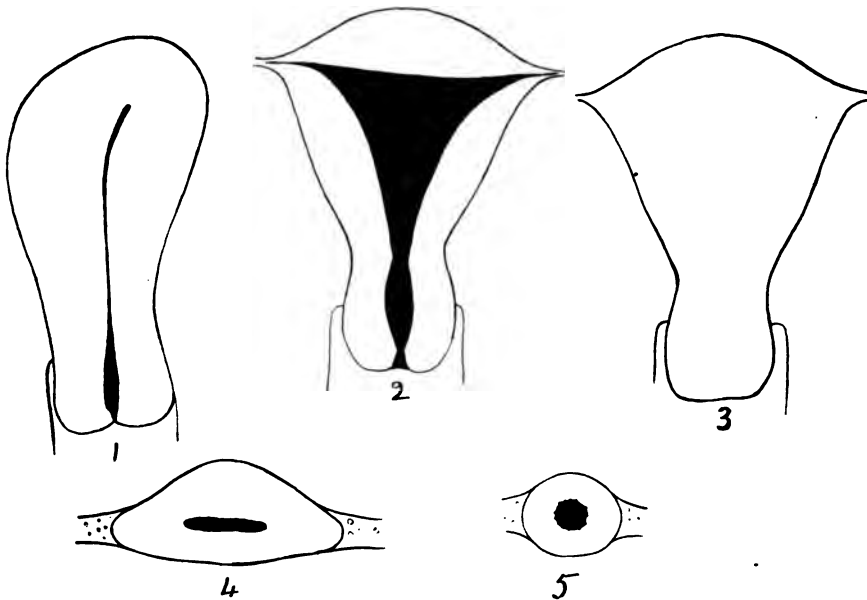


Fig. 4.—Uterus of a nullipara: 1, Vertical mesial section of the uterus; 2, coronal section; 3, contour of the uterus as viewed from the front; 4, transverse section across the corpus uteri; 5, transverse section across the cervix uteri.

STRUCTURE OF THE UTERUS.

Three coats are described—peritoneal, muscular, mucous.

The Peritoneal Covering.—This will be considered under “The Peritoneum” (*vide p. 76*).

The Muscular Part of the Wall.—This forms the main portion of the uterus. It consists of interlacing bundles of smooth fibers. It is difficult to make out as distinct an arrangement as is found in some of the lower mammals or in the pregnant uterus. The following have been described:

(a) An *external layer*, thinly developed, made up of prolongations from the Fallopian tubes, the broad ligaments, the ovarian ligaments, the round and uterosacral ligaments.

(b) An *inner layer*, well developed, in which the vessels run, and which is continuous with the muscle of the vagina. Between the muscle-bundles are

found elastic and ordinary connective tissue. There is a special arrangement of fibers around the inner ends of the Fallopian tubes, os externum, and os internum.

In the cervix there is a larger proportion of connective and elastic tissue than in the body. It is thus made very tough.

In the fetus and infant the musculature is more simply arranged. As the uterine body enlarges previous to puberty the arrangement becomes more complex.

Schwarz-Szasz points out that the elastic tissue is scanty in the virgin uterus, being only in the superficial layers of the muscular wall, where it is a fine network around the muscle-fibers, and underneath the stratified epithelium of the vaginal portion. It is found in the large but not in the small blood-vessels.

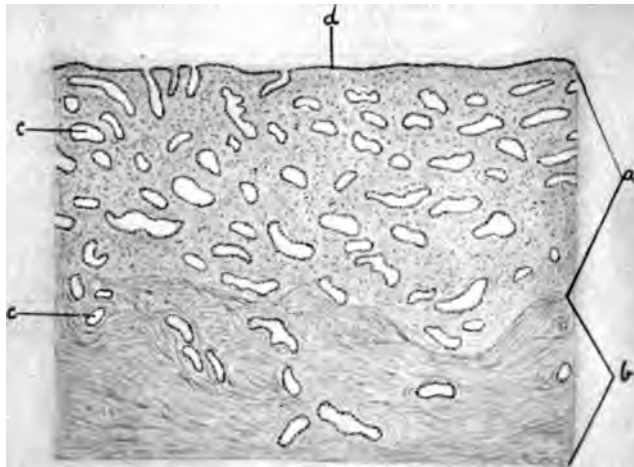


Fig. 5.—Section of normal uterine mucosa: *a*, Mucosa; *b*, part of uterine musculature; *c, c*, gland; *d*, epithelium covering mucosa (low power).

In the parous uterus there is much more elastic tissue, being more abundant the greater the number of pregnancies. It may be found as nodular thickenings.

THE MUCOUS MEMBRANE.

§ 1. **Mucosa of the Corpus Uteri.**—The mucosa of the body of the nulliparous adult uterus has, when examined fresh in the intermenstrual period, a fairly smooth surface, and is of grayish-pink color. With a low magnifying-glass numerous small pits, the openings of glands, can be seen. These vary in number in different places.

On microscopic examination, the thickness of the mucosa is found to vary considerably in different parts. In my specimens it varies from 0.5 to 2 mm. The average thickness is probably somewhat greater in the multipara than in

the nullipara. In detail, the mucosa is best described under the following headings:

Lining epithelium.

Glands.

Interglandular tissue.

Lining Epithelium.—This consists of ciliated columnar epithelial cells. Their nuclei are mostly elongated in the direction of the long axis of the cell; they are like short rods with rounded ends. Many are oval or ovoid; a few are rounded. For the most part they are placed in the deeper portions of the cells, only a small amount of cell-substance being below them; sometimes the nucleus is quite close to the margin. In some cases it is situated in the middle

or outer division of the cell.

The height of the cell varies.

This variation is due to differences in the amount of cell-substance or of nuclear material. In many places small cells are found between the bases of the large, fully formed cells.

The current produced by the movement of the cilia is directed from above downward toward the cervix. (Very rarely stratified epithelium may be found lining the cavity of the corpus uteri in advanced life.)

In many carefully prepared thin sections a layer of flattened connective-tissue cells, belonging to the interglandular tissue, can generally be recognized adhering closely to the under surface of the layer of columnar epithelium. It is to be regarded as a basement-membrane. In

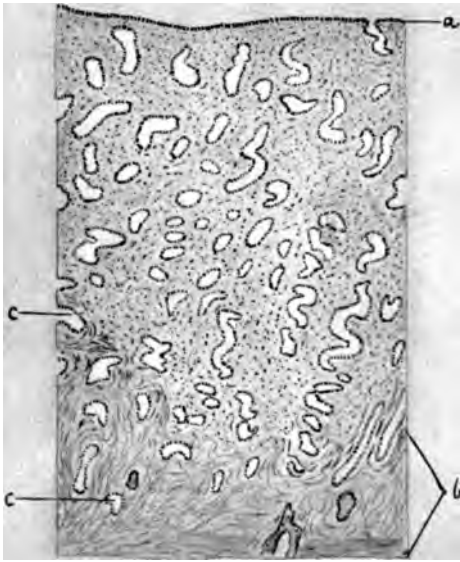


Fig. 6.—Section of normal uterine mucosa: *a*, Epithelium; *b*, portion of uterine musculature; *c, c*, glands (low power).

some specimens it cannot be everywhere distinguished.

Glands.—The glands are not uniformly distributed, being more abundant in some parts than in others. They are tubular, and are single or branched. The number of branchings is usually only two; sometimes more may be found. The divisions occur mainly in the deepest portion of the mucosa; sometimes in the outermost portions, even close to the surface. Very often they occur about the middle of the mucosa.

Most of the glands run obliquely to the surface, some being found, occasionally, almost parallel with it. A few only run at right angles to the surface.

Some are straight, others slightly curved; most are more or less tortuous or wavy. Of the latter, most are straight near the surface, but a few are wavy

in their whole extent. On transverse section the glands are round or somewhat oval.

Most of them extend to the muscular part of the uterine wall, some reaching it, others stopping a little short of it. Here and there glands extend into the muscular layer for varying distances.

The gland epithelium is of the same nature as that lining the surface of the mucosa, though, on the average, its cells appear to be a little larger.

The size of the epithelium varies in different glands. When a surface view is obtained, the outlines of the cell-ends appear to be more or less rounded, though some are quite irregular.

Interglandular Tissue.—This forms the main portion of the mucosa. Its line of junction with the muscle of the uterine wall is an irregular one. Muscular projections of different lengths extend into the deep portions of the mucosa.

It is composed of connective tissue of a low or embryonic type. It is best described as consisting mainly of delicate anastomosing nucleated masses of protoplasm. In some parts it is like a network with well-marked spaces, the anastomosing filaments being very fine. In other parts the matrix is almost a homogeneous, mucoid-like mass, containing rounded nuclei, very few spaces being seen, or scarcely any differentiation into distinct cells.

In general, however, more or less distinction exists between the cells, though, for the most part, they remain connected by strands of matrix of various sizes. Close to the surface of the mucosa the cells are usually flattened parallel to it. The larger the cells, the more elongated they are.

The nuclei are rounded or oval in general, the matrix surrounding them being irregular in shape, and possessing one or more branching processes. Here and there groups of cells are found which are rounded, oval, or spindle-shaped, with no anastomoses. Often the nuclei may be seen dividing. (This embryonic appearance of the interglandular tissue becomes more or less altered with advancing years, and in chronic endometritis.)

Close to the epithelium of the glands and to that of the surface is a layer of flattened cells forming a basement-membrane. To it the epithelium appears to be attached.

Arteries and veins extend from the muscular part of the wall into the mucosa for varying distances. The former run a tortuous or wavy course usually;

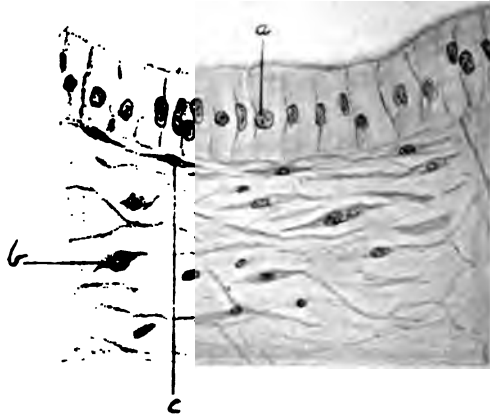


Fig. 7.—Section of normal uterine mucosa: *a*, Epithelium; *b*, connective tissue; *c*, basement-membrane (high power).

the latter, a straighter course. At what level they pass into the capillaries, which supply the superficial layer of the mucosa, it is difficult to say. As a rule, this seems to take place just about the middle part of the mucosa. In the superficial part I can find only capillary vessels, mere tubes of flattened endothelium. Occasionally a small arteriole, with scarcely any wall outside the endothelium, may be found in the superficial portion of the mucosa.

In some cases the capillary wall may have one or more layers of flattened cells of the interglandular tissue surrounding it. It is this appearance which has often been wrongly described by observers, who have supposed the vessels to be arteries. Arteries occur only exceptionally in the superficial mucosal region. There it is chiefly capillaries that are found.

According to Minot, the capillaries form a network around the glands. If he means that a special vascular mesh is particularly noticeable around them,

I cannot agree with him. They are found no more numerous near the glands than in any other part of the interglandular tissue, in which they are distributed in no uniform manner.

The spaces in the interglandular stroma contain lymph, and they are drained by lymphatics proper, which sometimes begin in the deeper layers of the mucosa, but for the most part in the musculature. Under the peritoneum there is a well-marked lymphatic plexus. In these spaces leukocytes are found, varying greatly in numbers in different parts.

In conclusion, I would point out that the mucosa might well be described in terms which

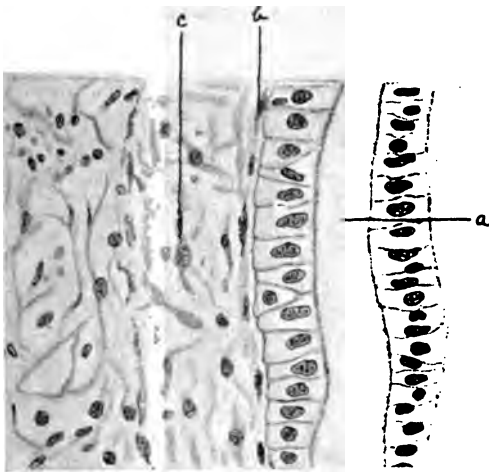


Fig. 8.—Section of normal uterine mucosa: *a*, Gland lumen; *b*, basement-membrane; *c*, connective tissue (high power).

are generally used only in reference to the altered condition of pregnancy, namely, compact and spongy; the former being the superficial portion, in which the glands have not, for the most part, begun to divide; and the latter being the deeper portion, in which are the branchings of the glands. Strictly, the spongy layer might be considered as consisting of two parts, a superficial and a deeper, the latter being that next the muscle, containing the most numerous gland-spaces.

The following points regarding the mucosa of the body of the uterus should be kept in view:

- (1) Its thickness is not uniform, but varies considerably.
- (2) The lining cells show variations in their height and thickness, in the shape, size, and position of their nuclei.
- (3) The same may be said of the cells lining the glands. In general these are larger than the surface cells.

(4) The interglandular tissue is mainly embryonic in nature, consisting of a nucleated protoplasmic reticulum. Here and there are found all stages of transformation to the more advanced spindle-shaped cells.

(5) The cells nearest the surface are mostly arranged parallel to it. A special layer of these exists as a distinct basement-membrane, and is generally found under the surface epithelium, as well as under that lining the glands.

(6) In the superficial layer of the mucosa the capillary junctions of the arteries and veins are the only vessels usually found.

(7) The line of junction of mucosa and muscular wall is an irregular one. There is no special muscularis mucosæ.

2. Mucosa of the Cervix Uteri.—When the cervix is opened by a vertical incision, the mucosa, red in color, is seen to be arranged in a series of folds. On the anterior and posterior walls is a vertical ridge with branching ridges extending from it,—the *plicæ palmatæ*,—the whole arrangement being known as the *arbor vitæ*. This does not extend above the os internum, but stops short of it usually. The mucosa is lined with columnar epithelium, ciliated on the prominent parts of the ridges. The cells are clear in their superficial parts, the nuclei being situated near their bases. They are true mucus-secreting cells. They rest directly on the main tissues of the wall, there being no submucosa. Glands communicate with the cervical canal; they are termed branching or racemose, but they are merely short depressions of the surface with lateral diverticula. The outline of each gland is thus serrated in longitudinal section. They are lined with columnar epithelium, more or less ciliated, lying on a basement-membrane. In the upper part of the cervix the glands tend to resemble those of the corpus in type. The region of the os internum is, in fact, a transition area. Just within the os externum the transition between the columnar epithelium lining the cervical canal and the stratified squamous epithelium which covers the vaginal portion takes place. The latter has a pinkish-gray color, very different from the red cervical mucosa.

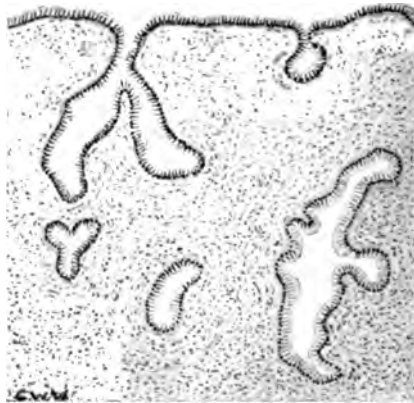


Fig. 9.—Normal cervix ($\times 55$).

The junction is found at different levels. As age advances the stratified squamous epithelium tends to be found higher in the cervix than in childhood. Rarely there may be a congenital condition in which the columnar epithelium is found external to the os externum (congenital ectropion).

The Uterus at Different Periods of Life.—At birth, the corpus is only slightly developed, being about one-third the length of the cervix, and of smaller width. It is usually bent slightly forward. The *arbor vitæ* extends to the fundus. This condition is found up to the period of puberty, with the exception that the lateral ridges of the *arbor vitæ* disappear from the mucosa of the corpus, and only a median ridge is left. Previous to puberty the body begins to increase in size until the normal adult relationship to the cervix is reached.

In the nulliparous adult the uterus is smaller and less rounded than in the multipara. The external signs of the junction of corpus and cervix are better marked in the former. In the latter the cavity is wider, and its triangular shape, as seen on coronal section, is less clearly defined. The os internum is less pronounced, the cervix is slightly shorter; the os externum is a transverse slit, irregular from fissures. A uterus which has passed through only one labor, the cervix not having been torn, may be very difficult to distinguish from a nulliparous one, after several years have passed.

After the menopause the uterus diminishes in size and becomes hard, owing to the sclerosis in the connective-tissue elements. The mucosa thins, the epithelial cells get smaller, lose their cilia, and may gradually disappear. The cervical glands are lost, and also those of the corpus to a large extent. Those which remain get completely surrounded and may form small cysts. In the senile condition there is great atrophy of the muscular and fibrous elements, the abundant elastic tissue being the most prominent feature. The elastic fibers resist atrophic changes longer than the others.

Schwarz-Szatz has made a special study of the changes in the uterus associated with increase in years. In the multiparous organ two types of changes occur in the blood-vessels:

1. Angiosclerosis, a form of senile decay consisting of hypertrophy of the tunica intima with necrosis and calcification, and of connective-tissue thickening of the media with hyaline degeneration.

2. Thickening of the walls of both arteries and veins, without special hypertrophy of the intima or degenerative changes. The lumen is much diminished. In advanced stages the media atrophies.

The latter changes are not found in nulliparæ. In young multiparæ they may be found to a slight extent.

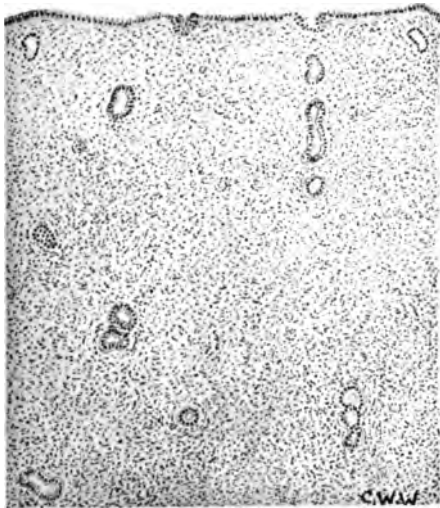


Fig. 10.—Post-menopause endometrium ($\times 30$).

Position of the Uterus.—

In the great majority of cases the uterus is placed in the anterior half of the pelvis (anteposed). When the bladder is empty, it lies so that the fundus is directed forward (anteverted), there being a slight curve on the organ, the concavity being on the anterior surface (anteflexed).

It may lie exactly in the middle line, but is often, as a whole, found somewhat to the right or left (more often the latter, according to Waldeyer). In some cases the long axis may not be sagittally placed, but may be directed so that the

fundus looks slightly to the left or right (lateriverted). In rare cases the organ may be situated far back in the pelvis (retroposed). In other cases retroversion may be a congenital condition. Very rarely in childhood the anteverted uterus may be also retroflexed.

As regards rotation of the healthy nulliparous uterus, there has been some discussion. In using this term it is necessary to distinguish between *inherent* or *true* and *secondary* or *accidental* rotation. By the former I mean a quality impressed upon the organ in its development and growth. It is only found occasionally. In the living subject a slight degree of rotation cannot be determined by physical examination. One cannot be sure that a supposed rotation is not caused by artificial disturbance of parts. Moreover, one cannot definitely eliminate accidental causes of rotation, *e. g.*, altered states of intra-abdominal pressure, varying conditions of distention of bowel or bladder, old

peritonitic or cellutic cicatrizations. It is important to note also that ordinary postmortem examination is not satisfactory in the determination of the exact relationships of the uterus nor of any other organ—frozen sections being necessary.

According to some writers, this alleged characteristic in the uterus is the result of a tendency to torsion possessed by most structures in the body. No doubt this tendency does exist in certain parts, but its significance is not clear.

As regards the uterus, were long-axis rotation one of its growth characteristics, we should expect to find it in the great majority of cases. As it is, we find it extremely rarely.

A careful study of the work of Ernst Fischer, the great authority on the subject of torsion, teaches us that we are not justified in referring this tendency to the human uterus.

Fischer's remarks refer to the organ, not in its single well-formed condition, but in its composite capacity as a double organ, formed by the blending of two lateral halves.

Fischer's description of a tendency to spirality in the uterus refers to each half, and he does not speak of a torsion of each Müllerian duct as a whole, but only of the muscular bundles. These, he says, show a tendency to homodromous spirality, according to the general law which he has formulated, namely, that structures in the right half of the body show a left spiral, and those in the left half a right spiral, arrangement. His conclusions are derived from the study of animals with double uterus and of cases of bicornute uterus in women.

In early fetal life there is no rotation distinguishable in the Müllerian ducts. But if this did exist, we should expect that, after blending occurred, there would be no torsion in the single organ, because of the neutralization of right and left homodromous characteristics.

The foldings in the early Fallopian tubes develop after the fusion of those parts of the Müllerian ducts which give rise to the uterus. Nagel states that they are due to the rapid increase in their length.



Fig. 11.—Vertical mesial section of fetal pelvis in sixth month of pregnancy.

Embryologic Explanations as to Relationships of the Uterus.—In early embryonic life the Müllerian ducts have simply a curve corresponding to that of the body. When they have reached the urogenital sinus and have become blended with the Wolffian ducts to form the genital cord, the latter, at the part which afterward becomes the uterus, forms a curve whose concavity looks forward. The angle of the bend is at the part which becomes the os externum (Nagel). This continues throughout development, the part above the angle forming the uterus. The condition is somewhat altered by the sinking down of the genital cord, and by the pressure of the intestines on the upper part of the uterus. A flexion tends to be especially marked on the upper part of the uterus, owing to the bending forward of the small fundus. In the latter months of embryonic life this condition is usually well marked, though the angle of flexion varies according to the condition of the bladder.

In the adult state the attachments and relationships of the uterus are of such a nature as to explain why the normal conditions should be found. The cervix is more fixed than the body. It is slung in a bridge formed chiefly by the uterosacral ligaments, the bases of the broad liga-

ments, the bladder and its ligaments. The body has a considerable range of movement, owing to the laxity of its connections. Born with a tendency to anteversion and anteflexion, the erect posture of the body and intra-abdominal pressure continue this. Probably the round ligaments, owing to their length, exert very little influence normally on the uterus.

In all mammals an anteverted condition of the uterus is found.

Normal Movements of the Uterus.—The uterus is continually moving—with each respiration, in walking, in singing, and in all actions which alter the relationship of intra-abdominal pressure to the organ. It changes in accordance with the emptying or filling of the bladder, and, to a certain extent, is affected by the distending rectum. The uterus and bladder behave practically as one organ in normal conditions. The anteflexion becomes less marked as the bladder raises the fundus.

The uterus can be made to move artificially through a considerable range.

It can be pushed up about $1\frac{1}{2}$ inches; it can be pulled down until the os externum is near the introitus vaginæ.

Special Ligaments of the Uterus.—The *broad ligaments* are described on p. 77. The upper portions of these have little influence on the uterus. The lower and thickest portions attached to the supravaginal part of the cervix act as uterine supports—the cardinal ligaments (Kocks) or ligamentum transversale colli (Mackenrodt).

The *round ligaments* are two flattened cords, 4 or 5 inches in length, which extend from the upper angles of the uterus in front of the inner ends of the Fallopian tubes. Each one passes upward, outward, and



Fig. 12.—Vertical mesial section of fetal pelvis in eighth month of gestation.

forward, invested with a covering of peritoneum continuous with the anterior layer of the broad ligament. It goes through the inguinal canal, and is directed toward the pubic spine, where it blends with the tissues of the mons veneris and labium majus. It is composed of connective and elastic tissue; there is also some nonstriated muscle, mainly in its inner portion, derived from the outer layer of the uterine musculature.

In the inguinal canal it gains a few striped muscular fibers, which arise from the internal oblique and transversalis abdominis muscles, as well as from the pubic spine; these correspond to the cremaster muscle in the male. The part of the ligament outside the canal has no muscular fibers.

Developmental Note.—In the fetus its early covering of peritoneum projects as a tubular

process into the inguinal canal. The peritoneal tube thus formed is called the canal of Nuck. It is sometimes permanent throughout life, though, generally, it becomes obliterated. It corresponds to the *processus vaginalis* in the male. When present after childhood it is a predisposing cause of hernia.

The *uterosacral ligaments* are two peritoneum-covered bands which pass from the outer parts of the posterior surface of the upper third of the cervix, outward, upward, and backward, to the upper part of the third sacral vertebra, sometimes higher. The inner margin of peritoneum is thin, and forms the upper boundary of the pouch of Douglas. The chief feature of each ligament



Fig. 13.—Vertical mesial section of pelvis of child. The shape of the uterus is peculiar. It is normally placed, the fundus being anterior, yet it is also retroflexed.

is a flat band of muscle extending along its outermost part. This band is called the *uterorectal muscle*, or the muscular retractor of the uterus. The projecting portion of the ligament contains scarcely any muscle; it is made up of loose connective tissue, which is continuous with the paraproctal and parametric tissues. Posteriorly the tissues of the ligament blend with those surrounding the rectum. The function of these ligaments is considered on p. 103.

Development.—The uterus develops out of the Müllerian ducts below the round ligaments. The development of the ducts has already been described (see p. 31). By the end of the third month the blending of the lower portions, by absorption of the contiguous inner walls,

is complete. This takes place as far up as the attachment of the round ligaments. During the remaining months of intra-uterine life the fundus uteri gradually develops.

For a time the uterus presents the external sign of its double origin, while at the part which afterward becomes the fundus, there is a distinct indentation.

The lumen is lined with high columnar epithelium. The lower end is closed, and is composed of large, irregularly rounded cells. This mass, on reaching the urogenital sinus, pushes forward its posterior wall and forms the eminence of Müller; from this mass of cells is developed the vagina (see p. 38). The two varieties of cells pass gradually into one another. As the embryo grows, the distinction becomes sharper. The junction between the two is the *anlage* of the os externum.

Another difference becomes marked between the portions of the genital tract, as regards their position. The lower or vaginal portion tends to be directed from above downward and forward; the upper or uterine portion, from above downward and backward.

A differentiation also tends to become marked between the epithelium of the corpus and



Fig. 14.—Vertical mesial section of fetal pelvis of large fetus at time of birth.

that of the cervix uteri. The former is less elevated than the latter, which is at first of several layers, the surface outline being wavy. This appearance is produced by the extension outward of the epithelium to form the glands of the cervix.

These cervical glands develop in the last half of intra-uterine life. The glands of the corpus begin to develop just before birth, or soon afterward; they are usually very scanty until puberty. No cilia are found on the cells at birth.

In the differentiation of cervix from vagina the posterior lip of the former first develops by the extension outward and upward of a sickle-shaped projection of the large rounded epithelial cells, just below the columnar cells; the anterior lip is next formed. The nonepithelial portion of the uterus is developed from the mesoblast which surrounds the epiblastic tube. According to Nagel, the muscle-fibers do not develop before the fifth month.

Notes on the Müllerian Tracts in the Vertebrata.—In the *Elasmobranchii*, the Müllerian and Wolffian ducts are distinct and open into a cloaca, as does the rectum.

In the *Holocephala*, where there is no cloaca, the distinct orifices of the Müllerian and Wolffian ducts open posterior to the anus.

In the *Ganoidei*, where there is no cloaca, the urinary and genital ducts open externally by a common aperture. In the *Teleostei* the genital ducts have a single opening anterior to and distinct from the opening which communicates with the urinary ducts. In the *Dipnoi* the blended lower ends of the Müllerian ducts open along with the ureters into a cloaca.

In the *Amphibia* the Wolffian and Müllerian ducts are distinct, and communicate independently with the cloaca.

In the *Sauropsida* the Müllerian ducts open independently or united into a cloaca.

Among these various classes it is important to note the existence in a few cases of a uterus or brood sac. Thus in *Squatina angelus*, a dogfish, the lower united ends of the Müllerian ducts form a dilation in which the young are developed for a period.

The same thing is found in certain other fishes and in several amphibians and reptilians.



Fig. 15.—Vertical mesial section through the pelvis of a multipara.

Thus in *Salamandra maculosa* each Müllerian duct, immediately above the cloaca, has a dilated portion in which the young develop. In these cases, it is to be noted, the uterus or brood sac is close to the outlet, there being no intervening vagina. Among the *Mammalia* various conditions are found.

In the lowest order is the *Ornithorhynchus*, in which the Müllerian tracts open separately into the urogenital canal, distinct from the opening of the urethra. The vagina is apparently not represented, the lower ends of the ducts corresponding to the os externum; they project somewhat like the portio vaginalis in the *Primates*. It is very interesting to note the presence in the virginal condition of hymeneal membranes which close the lower ends of the ducts, a very clear proof that a hymen may be formed between the urogenital canal and the Müllerian duct.

In the *Marsupialia* are found, generally, separate Müllerian ducts, each of which consists of a uterine and a vaginal portion. We find here, however, the first traces of blending. Thus,

in *Macropus major* the separate vaginae blend in their upper portions in a kind of sac, into which the uteri open.

In all the other mammalian orders the vagina is single and it is therefore evident that in the evolution of the higher types the uterus is later in becoming single than the vagina. The first appearance of union in the uterine cornua is in the marmot, in which they are bound together at their lower ends for a short distance.

In *Capromys pelorides* there is a single portio vaginalis with one os externum, though both uterine canals communicate with it. The next stage is the development of a single cervical canal, found in many mammals, e. g., *Phocæna*.

In the *Primates* the uterus is single and pyriform; in the *Lemurida*, it is bicornute.



Fig. 16.—Diagram illustrating the forward displacement of the uterus by a distended rectum.

THE VAGINA.

The vagina is a canal in the pelvic floor. It forms the passage from the cervix uteri to

the surface of the body. In front are the bladder, ureters, and urethra; behind, the pouch of Douglas, rectum, and anus. In the normal adult the lower

portion of the vagina is parallel with the plane of the pelvic brim. Ordinarily, the walls of the vagina are in apposition from before backward. The anterior wall is shorter than the posterior by the thickness of the cervix, which is attached to the upper end of the vagina. The measurements vary somewhat, the anterior wall being $2\frac{3}{4}$ to $3\frac{1}{4}$ inches (7 to 8 cm.), and the posterior $3\frac{1}{4}$ to 4 inches (8 to 10 cm.). The vaginal slit is widest in its upper part, and narrowest near the hymen.

On vertical mesial section it has a sigmoid shape; on transverse section, near the cervix, it is



Fig. 17.—Diagram illustrating the elevation and displacement backward of the uterus by a distended bladder.

bow-shaped; in the middle portion, H-shaped, and near the hymen it is an irregular transverse slit.

The upper end of the vagina is known as the vault or fornix. It contains the cervix uteri, whose os externum looks normally downward and backward. It is customary to divide the fornix into four parts in relation to the cervix, namely, anterior, posterior, right lateral, left lateral. The posterior fornix is the deepest, owing to the higher attachment of the vaginal wall to the cervix posteriorly, namely, at the junction of the lower two-thirds and upper third; the anterior wall is attached at the junction of the lower third and upper two-thirds.

Structure.—1. *The Epithelial Layer (So-called Mucosa).*—This consists of a layer of stratified squamous epithelium. It is thin and like skin, except that the *stratum corneum* is wanting. The epithelium is continuous with a similar layer on the vaginal portion of the cervix, on the hymen, and external genitals. Normally no glands are found in the vagina. Rarely, a few aberrant cervical glands may be found in the fornix.

2. *The Connective-tissue Layer.*—Under the epithelium is a layer of loose connective tissue in which small lymphoid nodules are found.

In the nullipara the wall of the vagina is markedly rugose, especially in the lower portion. Here is found a mesial ridge or fold, from which transverse ridges extend. The mesial column on the anterior wall is often double, and is usually longer than the posterior; as it is so intimately related to the urethra, it has been termed the *carina urethralis vaginae*.

Numerous papillæ are found on the vaginal walls. In the subepithelial tissue of these are found networks of capillary blood-vessels.

3. *The Muscular Part of the Wall.*—There has been some dispute as to the arrangement of the muscular structure of the wall. The main layer is one of smooth fibers, mainly arranged longitudinally, but many fibers are found running in other directions; it is continuous with the uterine musculature. It is stated by some that a special thin internal circular layer can often be made out.

At the vaginal outlet a special subcutaneous muscle has been described by Luschka—the so-called *sphincter or constrictor vaginae* (bulbocavernosi). It is thin, $\frac{1}{8}$ to $\frac{1}{4}$ inch broad, and embraces in a forked manner the vestibule and introitus vaginae. The levatores ani also act as a vaginal constrictor, being more important than Luschka's muscle. External to the latter is connective tissue containing abundant elastic fibers.

Physiologic Note.—The vagina serves as a collecting place for the semen

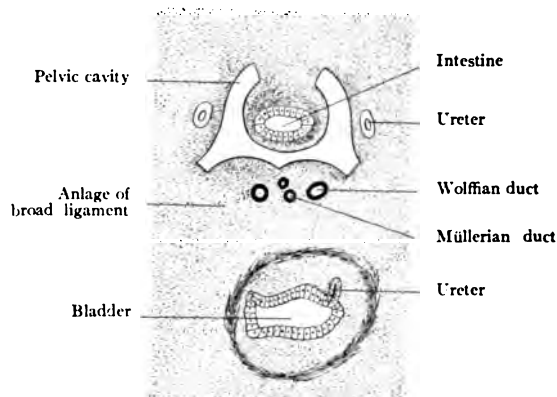


Fig. 18.—Section of pelvis in an embryo of nine weeks (Kollmann).

in copulation, and forms a passage for the escape of the uterine discharges and of the child during birth. It is, under ordinary conditions, merely a potential tube, its walls being in apposition. It is capable of great dilation. This is especially seen during labor, and is due to the fact that there is a great deal of loose tissue surrounding it, that the epithelial layer is loosely attached to the muscular, that there are many foldings of the inner layer, and that its wall is exceptionally rich in lymphatics, an arrangement which allows of much softening of tissues by serum.

As there are no glands in the vagina, it is kept moist from the uterine secretion which runs into it; and, also, by the transudation of fluid from the subepithelial lymph-vessels. The latter factor is most marked in pregnancy.

The secretion ordinarily found in the vagina is acid. The normal secretion of the uterine mucosa is alkaline. Consequently a change occurs in the vagina. This is probably due to the action of the numerous microbes which flourish there (see p. 130).

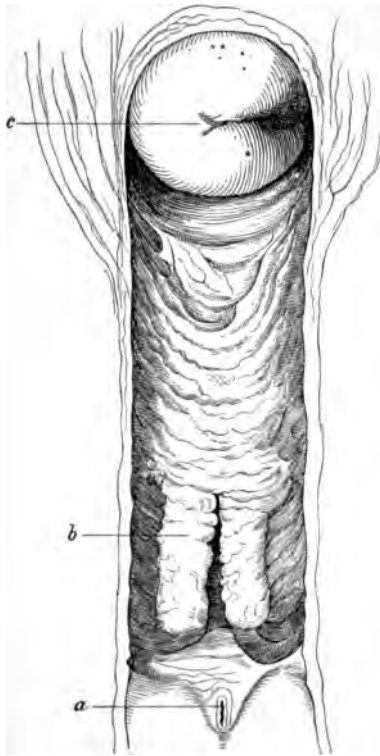


Fig. 19.—Anterior vaginal wall and multiparous cervix, looked at from behind: *a*, Urethral orifice; *b*, anterior vaginal column; *c*, cervix uteri (Henle).

this afterward forms the hymen; its central portion usually becomes absorbed.

Hart has shown that this takes place by multiple tubular ingrowths of epithelium covering the wall of the sinus, *i. e.*, the outer surface of the hymen.

This process of increase of the central stratified cells, followed by absorption, gradually extends up toward the cervix, and takes place in such a manner as to lead to the formation of the rugæ on the vaginal wall and on the vaginal portion of the cervix. This is completed by the sixth or seventh month. The rugæ can be seen on the cervix at birth. At this time cast-off portions of the stratified epithelium are found lying in the vagina.

The muscular fibers first appear in the outer part of the vaginal wall about the fifth month, the same time as it is first seen in the uterus.

Berry Hart's View.—Recently Berry Hart has advanced the following view:

Development of the Vagina.—According to most observers, its development occurs as follows:

Attention has already been directed to the differentiation of the epithelium, which is early found in the lower end of the Müllerian ducts (see p. 34); the lumen of the duct possessing columnar epithelium, the solid end below consisting of large polygonal cells. This end has been described as projecting outward to the wall of the urogenital sinus as Müller's eminence. This spot marks the future hymen, the center of the mass of cells gradually breaking down.

At first the vagina is very short—1 mm. in length. It gradually elongates *pari passu* with the formation of the urethrovaginal septum and shortening of the urogenital sinus. As it does so, its epithelial cells become somewhat smaller, those next the mesoblast lying in regular rows, those furthest from the mesoblast becoming flattened. There is as yet no distinct lumen. In an embryo at the beginning of the third month may be seen, at the lower end of the solid vagina, an accumulation of the flattened central cells to form a bulbous mass clear in the center, in which afterward the lumen of the vagina is formed. External to this mass is a thin, solid portion, which separates the bulbous enlargement from the urogenital sinus; this afterward forms the hymen; its central portion usually becomes absorbed.

Until the third month of fetal life the vagina is formed by the coalesced Müllerian ducts, ending blindly at their lower end; there is then no lower aperture, no hymen.

In the beginning of the third month a proliferation of the epithelial lining of the lower ends of the Wolffian ducts takes place, forming what he calls the Wolffian bulbs; peripheral cells are active, the central ones become less active and arranged in layers of squamous cells, resembling the structure of the vaginal epithelium at full time, as in the adult state.

The bulbs coalesce and break down in the center; at the same time their proliferating epithelium spreads up the Müllerian canal, displaces its epithelium, maps out the fornices, and covers the vaginal portion of the cervix, along with a small part of the lower end of the cervical canal. The hymeneal opening is brought about by the epithelial involution from the urogenital sinus meeting the distended Wolffian bulbs.

Hart believes that the Wolffian ducts are epiblastic in origin, and that this is the explanation of the skin-like covering of the vagina and vaginal portions of the cervix. The outer part of the hymen is, therefore, derived from the urogenital sinus, the inner part, from the Wolffian bulbs.

Changes in the Vagina after Puberty.—In a woman who has been subjected to coitus for some years the vagina is somewhat stretched, and the walls made less rugose than in the virginal condition. In a woman who has borne children, these features are very much more marked; indeed, the rugose condition may entirely disappear. After the menopause the lumen shrinks in size, mainly in the upper part, so that it becomes somewhat conic, the vaginal portion of the cervix remaining as a very small papilla, often scarcely recognizable to touch. In a multipara the walls become smooth at this time.

THE HYMEN.

In the nullipara the hymen is usually a thin, circular, perforated, membrane, which separates the vagina from the vulva. It consists of connective tissue, elastic fibers, and, occasionally smooth muscle-fibers, covered on both sides with stratified epithelium, and varies greatly in thickness in different cases. Glands have occasionally been found. Remnants of the Wolffian ducts have been described by Klein, Meyer, and others.

Variations are found as regards the position of the hymen, according to the depth of the vestibule. In negro women the deep vestibule is common, the hymen, therefore, appearing rather far from the vulva.

Usually, the free margin projects outward, the inner surfaces of the lateral halves being more or less in apposition. Sometimes it is formed as a projecting collar. The opening in the hymen is visible when the vulva is opened and the labia put on the stretch.

The opening is rarely central. Usually it is nearer the anterior than the posterior margin; often it is so far forward as to give the hymen the shape of a

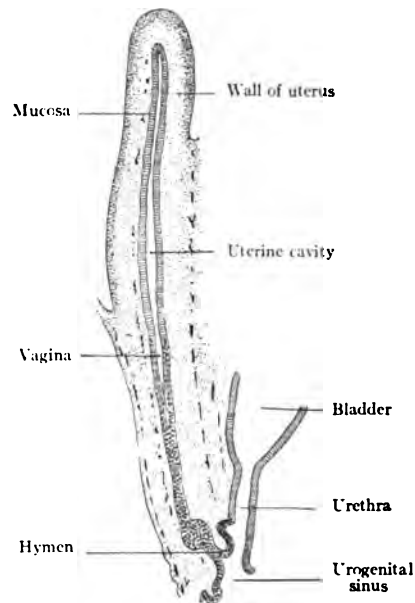


Fig. 20.—Vertical mesial section of genital tract in embryo 10 cm. in length (Tourneux).

half-moon. The free edge is smooth or irregular. Sometimes there is a double opening, one being in each half. Occasionally only a small, round opening or vertical slit is found, or there may be several small openings. Sometimes the slit is oblique, the left lip being rather posterior, and the right, anterior. When the opening is very large, the hymen has a falciform shape. Sometimes the margin is notched so as to form the *denticulate* hymen. This may be taken for a lacerated hymen; the notches, are, however, usually regularly placed, two being in front and two behind (Pozzi), and the free border can be shown to have no traces of cicatrization. Sometimes only one notch is found, sometimes two; in the latter case a tongue-shaped projection may be formed, giving rise to the *lingulate* hymen. Rarely a *fringed* hymen is found. Sometimes there is a thick band on the posterior part of the hymen—a prolongation of one of the columns of the vaginal walls, especially the posterior.

The size of the opening varies as well as the distensibility of the hymeneal structure. Ordinarily a finger can be passed into the vagina gradually with-

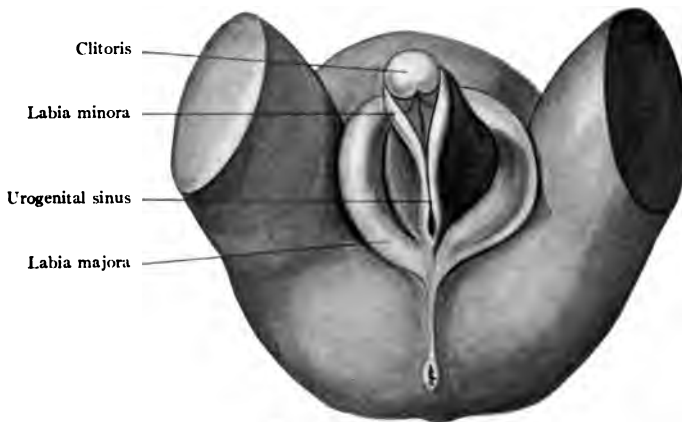


Fig. 21.—Diagram illustrating condition of external genitals in an embryo 7 cm. in length—eleven weeks (Kollmann).

out causing pain, if the hymen be not stretched by very wide separation of the legs. In all cases continued coitus causes a stretching of the structure, and, in most instances, laceration, varying in amount in different cases.

According to Brouardel and Laugier, a laceration of the hymen may heal completely, so as to appear uninjured; on careful examination, however, the white cicatrix may be found.

After the birth of a child it is usually torn and changed to a number (usually three to six) of tags, known as the *carunculæ myrtiformes*. This may also take place after a miscarriage, to a certain extent. But it is important to note that often after a miscarriage, and occasionally after a fulltime labor, no appearance of tearing may be visible, only great stretching having taken place.

Infantile Hymen.—In the infant the hymen is relatively somewhat more deeply situated than in the adult, owing to the depth of the vestibule. As compared with the adult condition it is, relative to the size of the labia, rather largely developed, and may sometimes be mistaken for the labia minora. Usu-

ally it projects forward, like the inverted finger of a glove, or with the lateral halves in apposition by their inner surfaces; it may be annular, or folded like a tobacco-pouch (Pozzi). The rugæ and pillars of the vagina are prolonged upon the posterior wall.

In young girls, if the thighs be widely separated, the hymen is stretched, and is rendered more difficult to penetrate. If they be brought together, the hymen may be considerably stretched, so that sometimes a finger or even a penis may be able to enter the vagina (Brouardel).

Sometimes a congenital condition is found in which there is quite a depression external to the hymen, above the fourchet. A similar appearance has also been described by Dolbeau as the result of attempts at intercourse, when penetration of the hymen was not effected.

According to Pozzi, there may be very often seen in children—and sometimes in the adult—a kind of hymen surrounding the urethra continuous with a raised band, which is composed of two lateral halves, which is again continuous

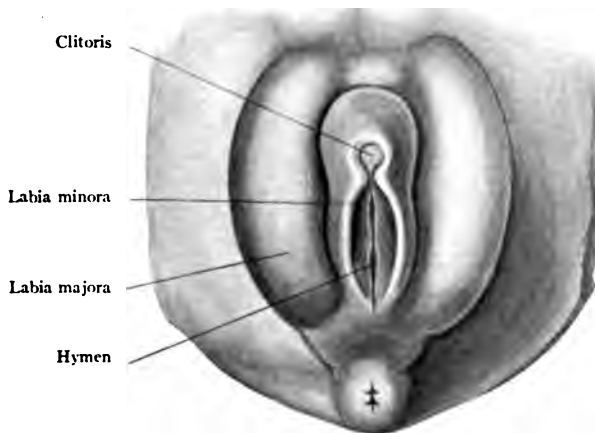


Fig. 22.—External genitals in embryo, 15 cm. in length—sixteen weeks (Kollmann).

with the collar of the hymen at the entrance of the vagina. According to Pozzi, this whole hymeneal arrangement is the homologue of the corpus spongiosum in man, the mesial band being known as the male vestibular band, and corresponding to the frenum found in male hypospadias.

Comparative Note.—In none of the lower mammals is a distinct circular hymen found, though in many—*e. g.*, horse, cow, pig, elephant, monkey, etc.—a constriction marks the lower end of the vagina.

In several, an anteroposterior band is found—a condition sometimes found in woman. In mice a plug of epithelial cells closes the lower end; this is renewed after each labor. I have already pointed out that in *Ornithorhynchus* the lower end of each uterine duct is closed by a membrane.

Development of the Hymen.—Various views are held and may be stated as follows:

1. It is derived from the sinus urogenitalis.

Pozzi regards the hymeneal arrangement as described above as the hom-

ologue of the corpus spongiosum in the male. He states that the hymen is developed from part of two lateral elongated projections, arising from the junction of the vagina and urogenital sinus, extending as far forward as the clitoris. These advance toward the middle line and blend in front of the vaginal and urethral orifices, the median blended portion left in the middle line of the vestibule being known as the male vestibular band.

2. It is derived from the Wolffian ducts.

Berry Hart states that the hymen is formed from a bulbous development of the lower ends of the Wolffian ducts, aided by an epithelial involution from the covering of the urogenital sinus.

3. It is derived both from the Müllerian ducts and the sinus urogenitalis.

Schäffer states that the hymen begins in the fifth month of fetal life in the form of two lamellæ, the inner being of vaginal origin, the outer, vulvar.

4. It is derived from the Müllerian ducts.

Many authorities hold this view, supported by von Kölliker, Budin, Dohrn, and especially Nagel.

The united Müllerian ducts reach the urogenital sinus and cause a projection of the latter—the Müllerian eminence, from which the hymen is formed. The epithelium of the sinus does not play an active part, but, according to Gellhorn, covers only the outer layers of the Müllerian epithelium in the form of a very thin cuticle. The hymen is at first entirely epithelial and is only secondarily invaded by connective tissue.

THE FALLOPIAN TUBES.

The Fallopian tubes lie in the upper free margin of the broad ligaments, being joined to the uterus, one on each side, at the cornua. Ordinarily they are from $3\frac{1}{2}$ to 5 inches (6 to 12.8 cm.) in length, and are often unequal. The direction of the tube, when the uterus is anteverted, is from the uterine cornu upward, outward, and forward, for a short distance; then upward, outward, and backward; then downward, backward, and slightly inward. In this way a curve is formed.



Fig. 23.—Fetal tube and ovary.

The inner part of the tube varies in position with movements of the uterus. The ampulla is capable of moving also, owing to the mobility of that part of the broad ligament to which it is attached. The fimbriated end is also freely movable.

The tube may be described in three divisions:

1. *Uterine or Interstitial Part.*—This is the innermost portion which runs through the uterine wall, to communicate with the funnel-shaped depression of the uterine cavity at the cornu. It admits only a fine probe, and enlarges gradually from within outward.

2. *Isthmus.*—This is the short, narrow, straight portion adjoining the uterus, measuring 2 to 3 mm. in transverse diameter.

3. *Ampulla.*—This forms two-thirds of the tube, and extends from the isthmus to the pavilion. Its lumen is larger than in the rest of the tube; it admits a uterine sound, and increases in diameter from within outward. Its

widest transverse diameter measures 5 to 8 mm. Usually one or more curves exist in this part, remains of the convolutions found in the fetus. There is a slight constriction where the ampulla passes into the pavilion.

4. *Pavilion, Infundibulum, or Fimbriated Extremity*.—This is the outer, funnel-shaped end of the tube, which is marked by a number of fimbriæ. A slight constriction of the wall marks its inner limit, but there is no muscular thickening worthy the name of sphincter. The ostium varies from 2 to 5 mm. in diameter, and is surrounded by fimbriæ. Ballantyne and Williams divide these into the major (musculomucous) and minor (mucous). The former number from three to five, the latter being placed between them.

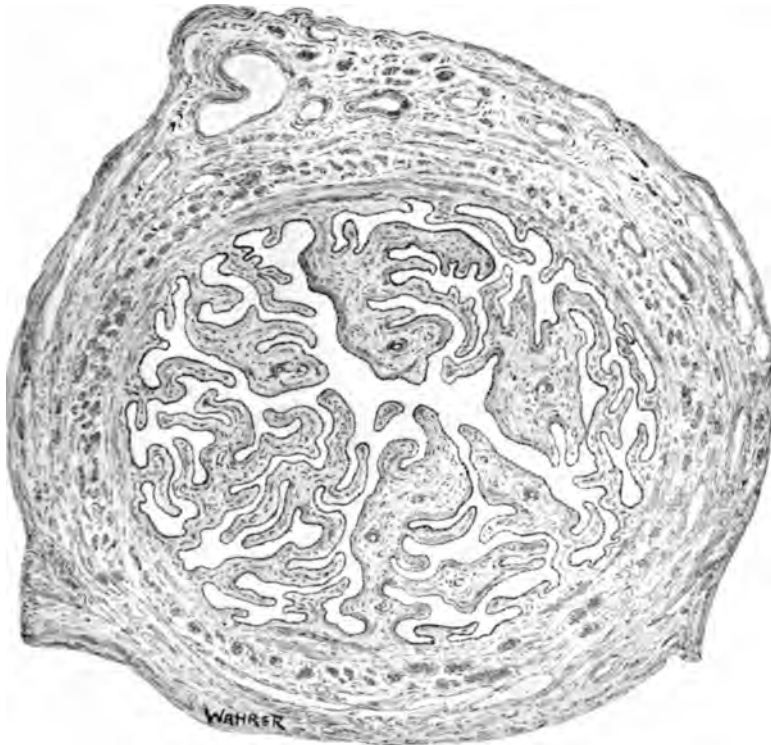


Fig. 24.—Cross-section of tube near infundibulum ($\times 14\frac{2}{3}$).

One of the former runs from the lower part of the tube along the free border of the broad ligament toward the ovary, to which it may or may not be attached. It is known as the ovarian fimbria, and is generally grooved on its mucous surface by a longitudinal furrow.

Structure.—It is usual to describe the tube as having a peritoneal, a muscular, and a mucous layer.

1. *Peritoneal Covering*.—This covers the ampulla, save on the lower surface. It is in reality the junction of the anterior and posterior layers of the broad ligament, and is for the most part loosely connected with the muscular

part of the tube. Close to the uterus it is more firmly attached. Between the two run vessels and nerves. Remains of the Wolffian body are sometimes found here. The large fimbriæ are covered on their outer surface and on their outer ends with peritoneum, the minor fimbriæ being usually entirely covered with mucous membrane.

2. *Muscular Portion*.—This is composed of two layers of smooth muscular fibers—an outer longitudinal and an inner circular. It is thickest near the uterus, and thins out toward the outer end. Both are of about the same thickness in the ampulla. In the inner end the circular layer is most marked. Near the fimbriated end the circular and longitudinal layers are broken up and form an interlacing network. Several observers have described a few longitudinal fibers internal to the circular layer in the uterine portion. These are well marked in the cow.

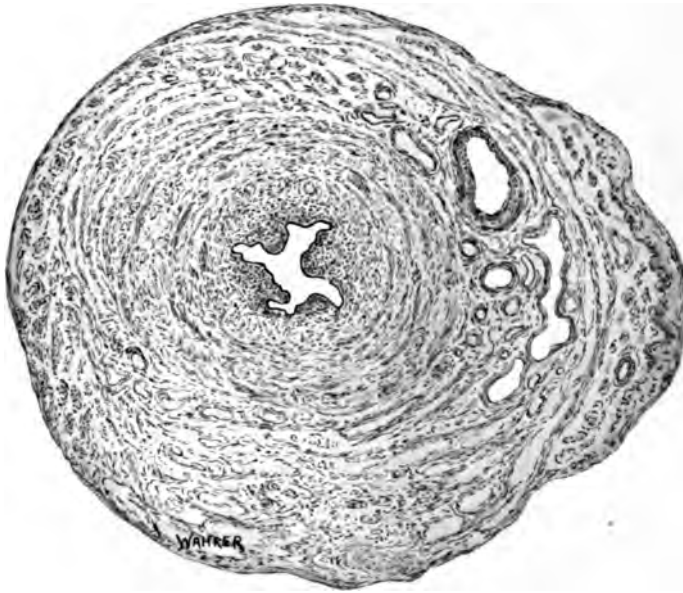


Fig. 25.—Cross-section of tube at uterine cornua ($\times 16\frac{2}{3}$).

3. *Mucosa*.—This increases in thickness and complexity from the uterine end outward toward the pavilion. In the uterine portion it is found in its simplest form, there being no fringes, the transverse section of the lumen having a somewhat stellate appearance. There is a small amount of submucous tissue of close texture. It is covered with ciliated columnar epithelium.

In the ampulla the mucosa is arranged in a series of longitudinal folds. These increase in number and size from the uterine end outward. On transverse section they appear as a number of delicately branched processes which occupy the entire lumen. These are covered with ciliated columnar epithelium. Under this is a delicate connective tissue, consisting of branching and round-cells, vessels, and nerves, part of which forms a kind of basement-membrane for the epithelium. The amount of this tissue resting on the

muscular part of the wall is very small. No glands exist normally in the tube, though a glandular arrangement may undoubtedly be simulated by the foldings. Occasionally the mucosa of the ampulla shows variations from this normal arrangement. It may in parts resemble that of the isthmus, even that of the corpus uteri containing glands; or there may be only a much less complex arrangement of the folds.

Variations in the structure of the tube are described on p. 410.

Development.—The Fallopian tubes are developed from the ducts of Müller. These structures arise as follows: In very early life (observed by



Fig. 26.—Pelvic cavity seen from above: 1, Fundus uteri; 2, round ligament; 3, tube; 4, appendix; 5, cecum; 6, rectum; 7, bladder (Sellheim).

Nagel in an embryo $\frac{7}{16}$ inch (7 mm.) in length), the celomic epithelium on the surface of the Wolffian body forms more than one layer, from the deepest of which Müller's duct develops in close proximity to the Wolffian duct, which is more deeply placed. It is a solid structure during the first three or four weeks. During the second month the rods become canalized. They gradually become separated from the celomic epithelium save at their upper end, and surrounded with mesodermal tissue, from which the musculature is derived. In an embryo $\frac{1}{2}$ inch (12 mm.) in length Nagel found that the Müllerian duct was a short, funnel-shaped tube open at its upper end. It was lined with columnar epi-

thelium save at the distal end, where it was cubic. Thereafter the ducts extended gradually along the ventral aspect of the Wolffian body until they approached the urogenital sinus. This stage has been found by Nagel in an embryo 1 inch (2.5 cm.) in length.

By means of a rotation inward of the lower end of the Wolffian body the Müllerian duct, which at first lay external to the Wolffian, is made in its lower part to lie internal. The lower ends of the two ducts are now closely applied. Their inner walls afterward coalesce to form a single duct (the uterovaginal tube). This takes place during the third month. From the upper unblended portions the tubes are derived. The bend made in the ducts, owing to the inward rotation of the Wolffian bodies, marks the lower limit of the tubes, for



Fig. 27.—Sagittal lateral section of pelvis of a multipara: *a*, Right lateral portion of bladder; *b*, tube; *c*, right ovary; *d*, infundibulopelvic ligament; *e*, cecum; *f*, broad ligament; *g*, right uterosacral ligament; *h*, right ureter; *i*, nerve of sacral plexus; *j*, levator ani; *k*, rectum (Sellheim).

here develop the round ligaments from mesodermal strands, leading to the anterior abdominal wall.

Around the primitive epithelial tubes the mesoderm has been arranging itself in a circular manner. This afterward forms the muscular and connective-tissue elements of the tube-walls. These can be made out distinctly by the fifth month. The upper end of the tube is at first a well-marked, rounded projection. Early it shows shallow notches. By the fourth month small fimbriae can be seen. At full time the epithelium lining the tube has cilia.

It is probable that the anterior end is formed from three invaginations of the celomic epithelium, representing pronephric funnels. Sampson Handley points out that the abdominal ostium is formed by a secondary dehiscence

of the upper part of the Müllerian tube, which causes the obliteration of two of the funnels, leaving the third as the hydatid of Morgagni. He holds that the ovarian fimbria represents the true upper end of the Müllerian duct, and not the hydatid, as is generally stated.

The folds in the mucosa begin in the ampulla about the fifth month. They are well marked at full time.

The Müllerian duct possesses a half-spiral turn inward, as already stated. After the fourth month several folds may usually be noted in the ampullary portion of the tubes.

Physiologic Note.—The tube serves to convey the ova to the uterus. The fimbriæ offer a large number of paths by which it may be led into the tube, though the fimbriated end plays but a passive part, so far as is known. There is no proof that it grasps the ovary while the ovum is being shed. It is well known, from experiments, that particles placed in the pelvic peritoneum are attracted to the tube by currents set up in the thin layer of serum on the peritoneal surface by the action of the cilia lining the fimbriæ. The ciliary movements in the cells lining the tube form a current which is directed toward the uterus.

Probably many ova never reach the tubes, but are broken up in the peritoneal cavity.

After the menopause the tubes get thinner, the muscle atrophies, the connective tissue becomes dense, the mucosal folds gradually disappear toward the inner part of the tube, the epithelium is more or less cast off, and may form a plug in the lumen.

Comparative Notes.—In several fishes there are no Fallopian tubes. The ova escape into the peritoneal cavity and afterward to the exterior. In some varieties this takes place even when there are tubes. In the cartilaginous fishes tube and ovary are in close union; in some the ovary is covered with a firm capsule, through which the eggs must burst. In bony fishes this capsule passes into the tube. From the amphibia upward, as a rule, the tube and ovary are separated, but in several species more primitive conditions are found. In *Ornithorhynchus* each ovary has a peritoneal capsule, and the outer end of the tube is a very wide funnel without fimbriæ.

In the *Carnivora*, in the rat, mouse, hyena, guinea-pig, ass, rhinoceros, and some other mammals, the ovary lies in an ovarian sac of peritoneum, which communicates with the peritoneal cavity by an opening. In the porcupine and baboon the sac is only partly formed. In the highest mammals the ovarian sac is absent, though in the lemur a rudimentary one is found.

In the lower vertebrates the outer end of the tube is a mere nonfimbriated slit. In the *Sauropsida* and lower mammals it is a wide, funnel-shaped opening without fimbriæ. In the higher mammals the human condition is usually found. In the sea-mammals, however, there are no fimbriæ.

THE OVARIES.

The ovaries, two in number, lie in the pelvis, one behind each broad ligament.

Form and Size.—Each is a somewhat flattened body, with the following measurements:

Length.....	1-2 inches (2.5-5 cm.).
Breadth.....	$\frac{3}{4}$ -1 $\frac{1}{2}$ inches (1.5-3 cm.).
Thickness.....	$\frac{1}{4}$ - $\frac{3}{8}$ inch (0.6-1.3 cm.).

It is thus evident that the size varies considerably. The right ovary is usually larger than the left. In describing the organ one can recognize two surfaces, a free border, an attached border, and two extremities.

One surface looks upward and inward, the other downward and outward. The free border is rounded, convex, and looks backward and inward. The border attached to the broad ligament is straight. The upper and outer or tubal extremity is directed toward the pavilion of the tube, the lower and inner or uterine extremity pointing toward the uterus.

Attachments.—The ovary is kept in place by the following structures:

1. *The Broad Ligament.*—The posterior layer of this ligament, to which

the border of the ovary is attached, is generally somewhat raised, is a kind of fold, and by some is called the *mesovarium*.

2. *The Suspensory Ligament*.—This is merely the upper free border of the outer part of the broad ligament—the infundibulopelvic portion—which runs from the ovary upward, outward, and backward to the psoas muscle. It is made up of connective tissue and a few smooth muscular fibers, and the ovarian vessels run in it.

The suspensory ligament varies as regards the extent to which it can be traced as a distinct peritoneal fold above the pelvic brim. In a small percentage of cases the upper termination is directly continuous with the lower part of the meso-appendix. In a much larger percentage it extends toward the region of the head of the cecum; in many instances, however, no peritoneal



Fig. 28.—Sagittal lateral section of pelvis of multipara: *a*, Right tube; *b*, right broad ligament; *c*, ovary; *d*, posterior portion of pelvic peritoneal cavity; *e*, nerve of sacral plexus; *f*, infundibulopelvic ligament; *g*, lymphatic gland; *h*, right ureter (Sellheim).

ridge can be found to extend between the true infundibulopelvic ligament and the region of the cecum or appendix. Treitz termed the peritoneal fold “*plica enterica*”; Rouget, “superior round ligament”; Clado, “appendiculo-ovarian ligament”; others name it “lumbo-ovarian ligament.” The fold evidently indicates the path taken by the ovary and its vessels in their descent from the abdomen to the pelvis, *i. e.*, from the region of the phrenic ligament of the kidney. It is wrong to describe the fold in special relationship to the appendix, with which it can have no developmental connection.

3. *The Ovarian or Utero-ovarian Ligament*.—This is a band in the posterior layer of the broad ligament which extends from the uterine end of the ovary to the upper part of the uterus, where it is attached between the round

ligament and Fallopian tube. It is about $1\frac{1}{2}$ inches (3 cm.) in length, and is composed of connective tissue and nonstriated muscle.

4. *The Ovarian Fimbria*.—One of the larger fimbriæ of the lower portion of the pavilion of the tube extends downward and inward along the broad ligament toward the tubal end of the ovary. In some cases it is directly attached to the latter, but in the other it is not.

Position and Relations.—The organ is attached to the upper part of the posterior layer of the broad ligament a short distance below the Fallopian tube. It is situated at the level of the brim, and near the lateral wall of the pelvis, usually resting against a slight depression—*fossa ovarica* of Waldeyer—on the inner surface of the obturator internus muscle. From the tubal extremity the long axis runs downward and inward, crossing the plane of the pelvic inlet obliquely. The ovaries may not have the same relative position on both sides, on account of the variations in the positions of the uterus. Thus, when that organ is nearer one side of the pelvis, the long axis of the ovary of that side crosses the pelvic brim more vertically than does that of the other ovary. The ovaries have a range of movement varying according to the mobility of their ligaments. They are also affected in position by movements of the uterus, by varying degrees of distention of bladder, small intestine, cecum, and rectum.

Naked-eye Appearance.—The outer surface is pale, and with a luster somewhat resembling that of a mucous surface, and has not the smooth, glistening aspect of a surface covered with peritoneum. It presents various rounded projections of varied sizes, caused by the underlying Graafian follicles in different stages of development, the largest of which may measure from $\frac{3}{8}$ to $\frac{7}{8}$ inch (1 to 2 cm.) in diameter. Furrows of different shapes and sizes are seen on the surface, and also puckered scars, due to the rupture of old Graafian follicles. The ovary feels somewhat like the testicle, but it is not so firm, being richer in lymphatics. When a section is made into it, clear fluid escapes.

At the junction of the ovary and broad ligament a slightly raised white line of tissue is seen—"the white line of Farre" (or "of Waldeyer"). It marks the junction of the peritoneum and the germinal epithelium covering the ovary.

Microscopic Structure.—The surface of the ovary as far as the white line is covered with low cubic epithelium; rarely this may be ciliated. The nearer the period of puberty, the higher are the cells of this layer. In advanced years they become considerably flattened and tend to disappear.

The substance of the ovary is made up of two portions:

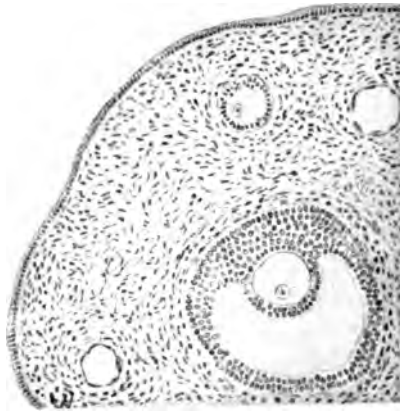


Fig. 29.—Section through portion of ovary of young woman. Several early follicles and a nearly ripe one are shown.

I. CORTICAL OR PARENCHYMATOUS ZONE.

This consists of a dense network of connective tissue, in the midst of which Graafian follicles of various degrees of development are found; it is more compactly arranged in the outer part. Elastic fibers are also found. According to Nagel, there are no smooth muscular fibers in it. It becomes thinner with advancing years.

In this layer are found three varieties of Graafian follicle, namely, primary, growing, and ripe.

The **primary follicles** are too small to be seen with the naked eye. In the adult they are found near the surface as an irregular double row, the individual follicles being considerably separated from one another. Each consists of a layer of low cells, derived probably from the original germinal epithelium, which surrounds the primordial ovum. The latter is a rounded cell with a single nucleus, very rarely with two nuclei. Nagel measured the ovary fresh in salt solution and found the diameters of the ova to vary from 48 by 54 μ to 64 by 69 μ . Sometimes two or three ova may be found in a single follicle.

The nucleus (*germinal vesicle*) situated in the center of the ovum measures from 29 to 32 μ . Trinchese and others have described around it a membrane with a double outline. There is a nucleolus (*germinal spot*) centrally or peripherally placed, as well as one or more paranucleoli.

The Growing Follicle.—These are found in the lower portion of the cortical layer. The first sign of growth in the primary follicle is that the cells surrounding the ovum become cuboid and increase in size and number, forming a mass of several layers. In this vacuolation occurs, forming a space in which fluid accumulates, the *liquor folliculi*, formed partly by transudation from the surrounding tissues, partly by the disintegration of cells of the stratum granulosum. Those cells which do not break down remain partly as a kind of stalk (*discus proligerus*, *cumulus oöphorus*) in which the ovum is embedded, and partly as a lining to the follicle—*membrana granulosa*—consisting of several layers.

While these changes are taking place in the stratum granulosum the surrounding connective-tissue elements are being arranged concentrically to form an outer covering of the follicle—the theca folliculi. This consists of two portions, the tunica externa or fibrosa and the tunica interna or propria. The latter is more cellular than the former, and is rich in capillaries. Between the theca and the *membrana granulosa* is a thin, structureless membrane, produced by the epithelial cells, according to Waldeyer.

About the time of the appearance of this so-called basement-membrane the thin, structureless vitelline membrane—*zona pellucida*—is formed around the ovum from the cells. According to Nagel, a very thin space, the perivitelline space, exists between it and the ovum. Next appears in the center of the protoplasm of the ovum the yolk particles (*deutoplasma*). As it increases, the germinal vesicle is pushed more toward the periphery; it is never surrounded by the yolk particles, and when the ovum is nearly filled with these particles, there still remains a thin covering of unaltered protoplasm around the vesicle.

The Ripe Follicle.—The mature follicle forms a projection from the surface of the ovary, the outermost portion of the latter being termed the stigma, the point at which rupture occurs. It is a more or less rounded structure, in which the following parts can be distinguished:

Y. A. S. B. L. I. B. R. A. R. Y.

1. *The Ovum*.—Sometimes two or more ova are seen. This is made up of the following:

Clear Protoplasm.—This is found as a peripheral layer, and as a thin layer surrounding the germinal vesicle.

Yolk Protoplasm (Deutoplasm).—This fills the greater part of the ovum, and is made up of coarse and fine particles with strong refractile powers. The larger particles occupy the center of the ovum.

Germinal Vesicle (Nucleus).—This body is rounded, its border having a double contour. It always occupies an eccentric position.

Germinal Spot (Nucleolus).—This has a somewhat yellowish appearance, and is capable of amoeboid movements. After death it breaks up into several parts.

Paranucleolus.—One or more can be seen. They appear to be thickenings in the protoplasmic reticulum of the nucleus.

2. *The perivitelline space*.

3. *Zona Pellucida*.—This has a radial striation.

4. *The Epithelial Cells Surrounding the Zona Pellucida*.—There are several layers of these, the inner two or three having their long axes arranged radially to the ovum. The inner row in particular has a longitudinally striated appearance, called by Bischoff the corona radiata. These striations appear to be continuous with those of the zona pellucida.

The outer cells are more rounded. They possess a finely granular protoplasm. The stalk of the discus proligerus is composed of cells very like those in the stratum granulosum.

5. *Stratum Granulosum or Membrana Granulosa*.—This consists of two or more layers of rounded, polygonal, and cuboid cells forming the inner wall of the follicle. Rarely, the cells may be ciliated.

6. *Liquor Folliculi*.—This is a clear, slightly yellow, glairy fluid, rich in paralbumin.

7. *Theca Folliculi*.—The inner layer is made up of more numerous cells than at an earlier period, and is more vascular. As the follicle approaches ripeness, there appear in these cells shining yellow particles. These are known, after the escape of the ovum, as the lutein cells. They play an important part in the formation of the corpus luteum.

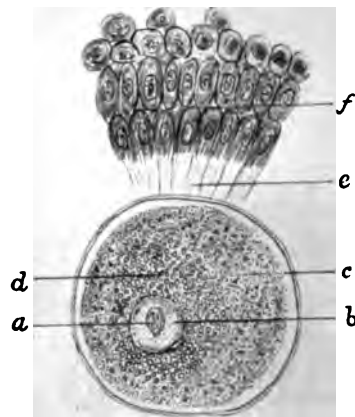


Fig. 30.—Ripe ovum with a few of the surrounding epithelial cells: *a*, Germinal spot; *b*, germinal vesicle; *c*, clear protoplasm; *d*, yolk protoplasm; *e*, corona radiata; *f*, epithelial cells.

II. MEDULLARY OR VASCULAR LAYER.

This forms the central portion of the ovary, and is continuous with the broad ligament through the hilum. It consists of a connective-tissue stroma, smooth muscle-fibers, and is very rich in blood-vessels. There is a well-

marked plexus of arteries and veins in the hilum. Lymphatics exist and form networks around the Graafian follicles. Remains of the Wolffian body in the shape of short tubes lined with ciliated columnar epithelium may be found in the hilum.

Variations in the relationship of the ovary to the Müllerian tract must be noted. The ovarian fimbria, for example, may, in some cases, not reach the ovary; sometimes it may just touch it; sometimes its tip may be embedded in the ovary; sometimes a considerable extent of the fimbria may lie against the ovary or be adherent to it; in some cases there may be a break in its continuity, so that a small outer portion may lie close to the ovary, detached from the main part. Marchand has directed attention to the early close relationship between the tubal epithelium and that covering the surface of the ovary, and has pointed out that they are one and the same surface. He believes that in some cases the line of demarcation, instead of being at the end of the ovarian

fimbria, might reach over to the lateral portion of the ovary, and that from it processes might extend into the cortex of the ovary. The observations of De Sinety and Melassez in 1878 seemed to establish the correctness of such a view. Other studies, especially those of Whitridge Williams, leave no doubt as to the occasional extension of Müllerian tissue into the ovary.

In this connection may be mentioned the occasional occurrence of localized areas of decidua-like cells in the ovary during uterine pregnancy. The author is inclined to believe that these cells belong to portions of included Müllerian tissue.

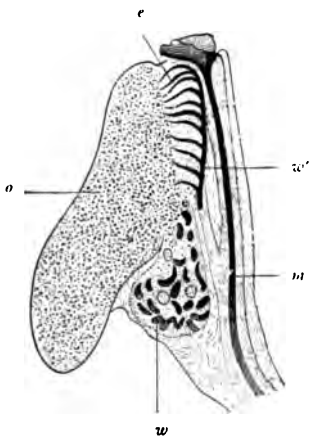


Fig. 31.—Internal organs of a female fetus of about fourteen weeks: *o*, Ovary; *e*, epoöphoron or parovarium; *w'*, Wolffian duct; *m*, Müllerian duct; *w*, lower part of the Wolffian body (Waldeyer).

Development.—The ovary is developed from epiblast and mesoblast on the inner surface of the Wolffian body. The epiblast, a specialized portion of the celomic lining, very early forms a mass consisting of several layers of cells—the germinal epithelium. In the deepest portions certain of these cells increase

in size and give rise to the primordial ova. The formation of the latter ceases at birth.

As this layer increases in thickness, processes of the underlying mesoblast of the Wolffian body extend outward among the germinal cells, forming a network-like stroma, in the meshes of which lie primordial ova frequently surrounded by germ-cells. The latter probably give rise to the lining of the primary follicle later known as the *membrana granulosa*. Foulis in 1878 stated that the cells surrounding the primordial ovum are derived from the connective tissue. Wendeler and Clark have more recently advocated this view. The latter has pointed out that the cells are usually spindle-shaped in the early stages, and that frequently primordial ova are found without any special layer of cells surrounding them. Kölliker taught that the follicular epithelium was derived from Wolffian epithelium.

As the ovary grows, it becomes raised from the surface until it is attached only by a narrow hilum. The surface remains covered with germinal cells. Extending inward from this layer may be seen, occasionally, columns of similar cells, which have not been cut off by the stroma.

At birth the germinal cells on the surface form a single layer. The ovary is composed mainly of cortex, which is made up of primary ova and primary follicles lying in delicate connective tissue. According to Waldeyer, at least 100,000 are present. In the years between birth and puberty more than half of these disappear. Throughout sexual life this diminution continues, the stroma becoming more prominent as age advances. The development of the primary into the Graafian follicles begins before puberty, as a rule, though it may take place in fetal life or in childhood. These early ripened ova have the same appearances as those found in the adult, but they never reach more than half the size, and rarely ever rupture.

Stevens has made an interesting study of changes occurring in the Graafian follicles in premenstrual life as follows:

The follicle and contained ovum mature to a certain point, no definite corpus luteum being formed. The single layer of flat cells surrounding the dormant ovum proliferate and become somewhat cubical; several layers are formed—*membrana granulosa*. The ovum increases, and is surrounded by a discus proliferus; there are a *zona radiata* and *liquor folliculi*. At its greatest, the follicle measures about 0.8 by 0.7 mm., the ovum, 0.1 by 0.095. The *tunica fibrosa* is well marked; it is like the ovarian stroma, only more vascular. Sometimes excessive liquor folliculi collects. Retrograde changes gradually develop. The ovum is invaded by cells, which are apparently phagocytes, derived probably from the *membrana granulosa*. Their protoplasm is vacuolated and they do not resemble leukocytes. Necrobiosis gradually develops. Most *granulosa* cells disintegrate. The *zona radiata* is very resistant. The *tunica fibrosa* gets many capillaries; the connective-tissue cells multiply; on the inner surface a hyaline layer of fibrin forms, in which new connective tissue gradually develops. The follicle gradually shrinks, leaving a small scar area.

Escape of the Ovum.—The opening of the ripe follicle is a process which occurs independent of menstruation. Formerly it was believed to be due to increase of intrafollicular pressure by the accumulation of liquor folliculi.

Nagel holds that the increased pressure is brought about in the following manner. There is a great increase in the thickness of the inner layer of the theca folliculi, owing to the swelling of its cells with yellow particles (lutein cells), and to its becoming arranged in a wavy manner (Nagel). The cells become larger and epithelioid in character. (Some authors hold that they are

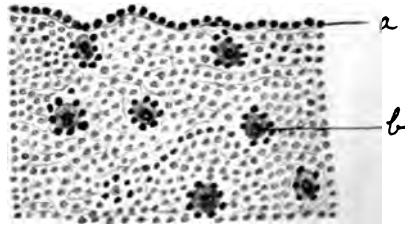


Fig. 32.—Section of ovary of a new-born child: *a*, Germinal epithelium; *b*, primary Graafian follicle.

derived from the membrana granulosa, but this is not the case. The cells of the latter degenerate and are mostly shed at the time of rupture.) Between the membrana granulosa and the yellow body unchanged connective tissue—a kind of basement-membrane—can usually be detected. Into the portions which project inward many vessels extend. Owing to this pressure from without the contents of the follicle are forced in the direction of least resistance, namely, outward, thus breaking the thin covering of the follicle known as the stigma.

Clark states that rupture is due to changes in the circulatory conditions in the ovary. Owing to the marked engorgement of the organ, tension is increased and the ovum is forced to the surface. The vessels which lie external to the follicle at the place of bulging are compressed, and, owing to this interference, the tissue is apt to necrose and break down.

Pari passu with the development of the lutein cells there is a fatty degeneration in the cells of the stratum granulosum and in those of the discus proligerus. This enables the ovum to break loose from its covering cells.

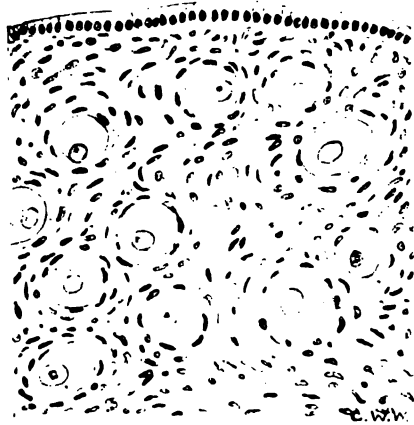


Fig. 33.—Section through a developing ovary. The primary follicles are seen.

Formation of the Corpus Luteum.—After the ovum escapes, the follicle containing degenerating epithelial cells is filled with a blood effusion. The opening of the follicle closes, and the wavy yellow band of lutein cells increases in thickness and presses further inward. The lutein cells are polygonal and epithelioid in character, with small round, lightly staining nuclei. The pigment may be dissolved out with chloroform, alcohol, and ether, so that in ordinary preparations many spaces may be seen.

Strands of vascular connective tissue spread in all directions among the cells. Gradually the lutein cells begin to disappear, so that the yellow color is lost, and in their place new connective tissue develops. A thin layer of the latter also extends around the inner surface of the lutein mass.

Simultaneously, branching fibroblasts invade the central blood-clot, which gradually diminishes and becomes decolorized, the pigment being chiefly carried away by leukocytes. Lockyer states that this tissue is not vascularized and takes no share in regenerative processes. Strands of the outermost active new connective tissue, extending inward, gradually break up the fibrinous decolorized clot. The latter undergoes hyaline degeneration and is highly refractile. In this condition the mass is known as a *corpus fibrosum* or *albicans*. Toward the end of the reproductive life, when absorption is not so rapid, these areas are more in evidence than at earlier periods. Very frequently they are broken up into fragments of irregular shapes and sizes, many of which are tortuous bands.

In some cases, at the time of escape of the ovum, there is little or no hemor-

rhage into the cavity, so that no central clot is formed, a condition which is normal in many lower mammals, *e. g.*, the rabbit. The lutein cells may not be completely destroyed by the invading leukocytes and fibroblasts, and portions may be gradually disseminated through the surrounding ovarian stroma. Lockyer points out that several of these may fuse together, and by central vacuolation give rise to a cyst.

Sometimes, owing to excessive hemorrhage, a hematoma may form. Changes in the central blood-clot may also give rise to a cyst.

The terms "true corpus luteum" and "false corpus luteum" should be abandoned. The former is applied to the condition found when pregnancy occurs, the latter referring to that found in the nonpregnant state. There is no difference between them save as regards duration.

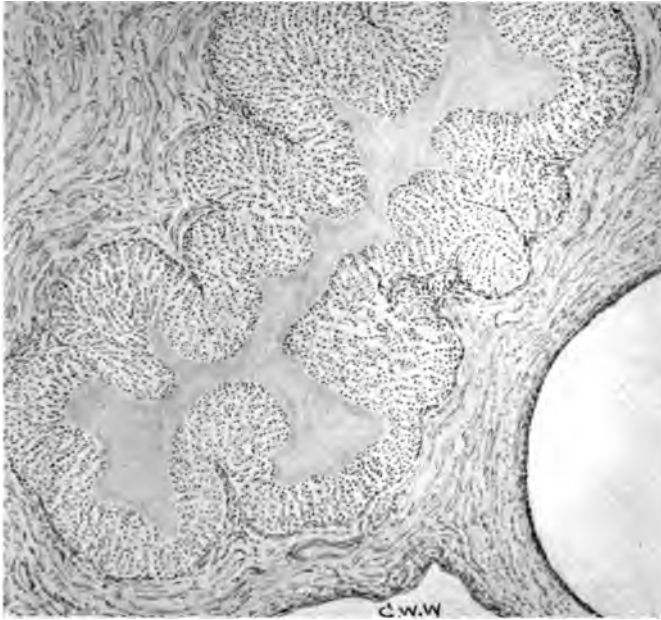


Fig. 34.—Fresh corpus luteum ($\times 36_{10}$).

When pregnancy follows on ovulation, the corpus luteum takes several months to become reduced. When pregnancy does not occur, this happens in a few weeks.

Besides the well-formed follicles which rupture, many seem to break down in the normal ovary. A yellow body may form, owing to the formation of lutein cells in the theca. As a rule, no hemorrhage takes place in the cavity. The ovum and surrounding epithelium degenerate and get absorbed along with the liquor folliculi. In these conditions leukocytes have been seen to penetrate to the ovum. Notwithstanding these changes in the ovary during sexual life, the size of the organ remains pretty constant. Toward the menopause it diminishes. After the menopause it is hard, shrunken, and irregular;

the external epithelium becomes flattened and largely disappears. The Graafian follicles are wanting. The connective-tissue stroma is dense and hard, especially at the periphery (at this time often called the "tunica albuginea").

The Functions of the Ovary.—In addition to furnishing the ova, it has long been recognized that the ovary exercises an important influence on the body, though the nature of the influence and the changes induced by it have been and still are unknown. Recently, various workers have suggested that the ovaries are ductless glands, whose internal secretion affects general metabolic processes.

Several years ago it was noted that in many cases of osteomalacia the disease could be checked by removal of the ovaries. Fehling, a pioneer in this line of work, made a careful study of the urine in his cases, but gained no information as to metabolic changes by comparing its condition before and after operation.

In 1894 and 1896 Neumann stated that removal of the ovaries in this disease exercised a marked effect in lessening the excretion of magnesium, calcium, and phosphorus, as well as diminishing proteid disintegration. Later, Neumann and Vas experimented on normal female

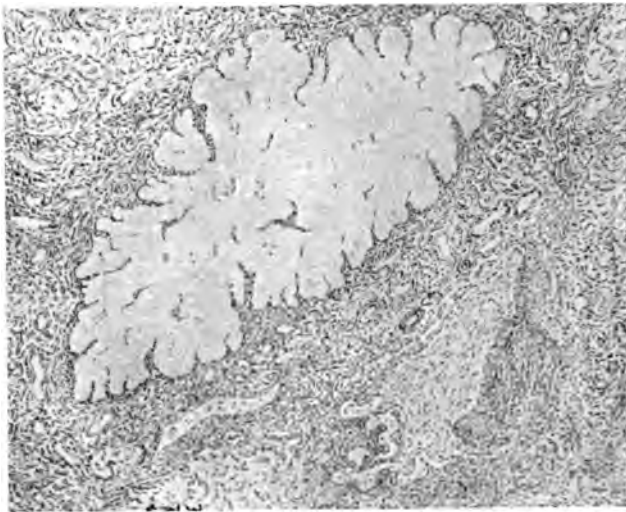


Fig. 35.—Corpus albicans ($\times 361_0$).

animals, and found that Merck's ovarian tabloids, even in large doses, did not appreciably alter the quantity of nitrogen or phosphorus in the urine. They found, however, that there was an increased excretion of these when their own preparation of cow's ovary was administered. They also noticed no pronounced alteration in the phosphorus excretion after removal of ovaries from animals. When ovarian tabloids were given to spayed animals, there was increased excretion of calcium and phosphorus and less marked nitrogenous excretion.

The experiments of Curatulo and Tarulli, in 1895, have attracted a good deal of notice. They fed bitches on a regular diet until there was a uniform average daily excretion of phosphorus and nitrogen. The ovaries were then removed, and thereafter the excretion of phosphorus was much diminished. They concluded that the ovaries produced an internal secretion, of unknown nature, which influenced the oxidation of organic substances containing phosphorus which enter into the structure of bone. In accordance with their view, it has been widely believed that the beneficial influence of the removal of the ovaries in osteomalacia was due to the retention of more phosphorus in the system and its deposition in the bones in the shape of phosphates.

In 1899 Falk repeated these experiments, but did not arrive at the same conclusions. After removal of the ovaries in two bitches he noticed no difference in the amount of phosphorus excretion.

Moreover, recent investigations regarding the source of the excreted phosphorus tend to

lessen the value of these experiments. They appear to show that much of the phosphorus is derived from nucleoprotein in food, and it is possible that the increased excretion after the administration of ovarian tissue or extract is thus explained. Curatulo also holds that the ovarian secretion favors the oxidation of carbohydrates and of fatty substances, and explains the tendency to corpulency when the ovaries are removed in the reproductive period of life, or after the menopause, as due to the loss of the ovarian secretion.

The results of various experiments in the administration of ovarian tissue or extract in the human female have in no way helped to throw light on the subject under consideration, nor have they tended to uphold the theory of an internal secretion. The use of the gland in various diseased conditions of the pelvis has not served to give to it any definite therapeutic value. Neither has its administration at the time of the climacteric served to ameliorate or dispel the troubles incident to that period. Results, good, bad, and indifferent, have been published, leading strongly to the conclusion that in the cases observed only the same variations in clinical features have been recorded which may be recognized when any group of menopause cases is studied uninfluenced by any medication.

Whatever the influence of the ovaries may be, it seems to be established that they affect the organism through the circulation and not through the nervous system, and thus support is given to the theory of an internal secretion. Many experiments have been made in transplanting the ovaries of animals from their normal situation to some other, *e. g.*, the peritoneum, subcutaneous tissue, muscles, etc. While after transplantation some of the ovarian tissue usually necroses, the remainder generally lives and continues to functionate, ova continuing to develop, ripen, and even to escape from follicles. When this activity continues, no matter where the ovary is placed, the genitalia and mammae remain well developed just as though the organ is in its normal position. Removal of the ovaries in the reproductive period of life is followed by changes similar to those which occur at the normal climacteric.

The Role of the Corpus Luteum.—Recently the view has been advanced that the internal secretion of the ovary is produced by the corpus luteum, and that the latter structure exercises very important functions in the female organism. The late Gustav Born, of Breslau, was the first to bring forward this hypothesis, stating that the particular function of the corpus luteum was to favor the embedding and development of the fertilized ovum in the uterine mucosa.

Ludwig Fraenkel has also published an elaborate paper in which he states his belief that an internal secretion produced by the yellow body keeps up the nutrition of the uterus during reproductive life, leads to the phenomena of menstruation, and favors the embedding and development of the fertilized ovum. Uterine atrophy and amenorrhea are brought about when no corpora lutea are found. Thus are explained the conditions normally found before puberty and after the climacteric. The facts upon which this remarkable hypothesis is based are derived mainly from experiments carried out on rabbits, since in these animals the time of occurrence of the various stages of gestation, following insemination, are fairly accurately known.

In endeavoring to determine the influence of the ovary on implantation of the fertilized ovum, Fraenkel removed the ovaries from thirteen rabbits, one to six days after copulation. Later these animals were killed, and in no instance was an ovum found in the uterus. In another series only one ovary was removed, and this did not interfere with gestation. It seemed, therefore, that implantation had been prevented by removal of both ovaries.

In another series of rabbits the ovaries were removed after implantation of the ova, and it was found that their development ceased, though they were not expelled from the uterus.

Similar results were obtained when, instead of removing the entire ovarian tissue, the corpora lutea were destroyed with a cautery. It was found that development of the ovum might continue if only one corpus luteum was left in the ovary. When the ovaries were transplanted, destruction of the ovum occurred, though after some delay. After burning the corpora lutea from the ovaries, it was found that the uterus was much atrophied in two weeks.

No observations have yet been made to enable us to speak with any certainty regarding the application of these theories to the human female. Essen-Möller has described the case of a woman operated by Borelius, of Lund, from whom two cystic ovaries were removed on September 6, 1903. The uterus was noted as being somewhat enlarged, and there was a corpus luteum in one ovary. She was delivered of a child two hundred and sixty-nine days after the operation. It was evident the removal of the ovaries had not interfered with gestation.

This physiologic interpretation of the function of the corpus luteum is worthy of the highest consideration. Hitherto, anatomic explanations have been chiefly prevalent. Thus, it has been considered as forming an extra protective covering to the ripening ovum, as a plug to check hemorrhage after bursting of the follicle, and as a kind of splint steadying the tissues during the process of healing. Clark has pointed out that it is evidently associated with a method of repair, which leads to little formation of connective tissue, and has well stated that if the ruptured follicles were healed by the ordinary method, the ovary would be converted into a mass of connective tissue which would render the escape of ova increasingly difficult.

On the other hand, Fraenkel and others who adopt the physiologic interpretation emphasize the well-known structural resemblance of the fully formed corpus luteum to a ductless gland, since it consists of rows of large epithelioid cells—the lutein cells, arranged somewhat radially,

strands of delicate connective tissue containing blood-vessels ramifying between the columns. Fraenkel holds with Sobotta and others that the yellow body is derived from the *membrana granulosa*, and that thus an epithelial origin is obtained for the cells of the glandular organ. I have already pointed out that many authorities hold that the corpus luteum is derived not from the *membrana granulosa*, but from the connective tissue external to the latter, while a considerable number hold that the *membrana granulosa* is itself of connective-tissue origin. If the latter view be correct, and the glandular nature of the corpus luteum be established, such a marvelous transformation of connective tissue is without parallel in any other portion of the human body. But even if its origin be epithelial, it is equally remarkable and unique that a glandular function should be carried on during many years by a continued series of new formations in different portions of an organ.

In considering Fraenkel's hypothesis, various questions suggest themselves for investigation. If the corpus luteum causes the phenomena of menstruation, why is the latter function limited to the primates? Born has pointed out that in all animals in which there is a uterine insertion of the ovum there is a well-developed corpus luteum, whereas in all other animals the latter is either rudimentary or not developed at all. In all mammals above the monotremes the ovum is implanted in the uterus and the corpus luteum is well developed. The absence of menstruation in the great majority of these must either be due to some peculiarity of the corpus luteum or to other unknown reasons.

If the corpus luteum presides over the implantation of the ovum through its internal secretion, does the latter influence the ovum by passing to it through the maternal tissues (where presumably it circulates), or is the ovum already influenced at the time it escapes from the follicle? Fraenkel's experiments seem to negative the latter hypothesis, for if the ovum reaches the uterus already charged with the secretion, destruction of the corpora lutea in the rabbit might not be expected to affect its implantation. It is, therefore, more reasonable to suppose that contact with the uterine mucosa in which the ovarian secretion circulates leads to the conditions which determine the embedding of the ovum. From histologic studies it is now known that the implantation of the ovum in the mammalia occurs after certain changes have taken place in it, that in the vesicular stage there is a proliferation of the outer layer of epiblast forming the trophoblast, which has the power of attaching itself to the uterine mucosa, of absorbing the latter and burrowing into it. Is this power dependent upon the influence of a circulating ovarian secretion? Hitherto it has always been believed that these changes were possessed by the ovum itself, for in animals developed from ova which find no resting-place in the body the development does not depend upon the maternal organism.

It must, however, be believed that in the higher mammals, at least, some special complementary characteristic must be found in those areas of maternal tissue on which the ovum grows. In the human female, for example, a particular portion of the Müllerian tract, viz., the mucosa of the corpus uteri, is the normal seat of implantation, and in this area characteristic decidual transformation occurs. Is it possible that this peculiar change is brought about by the ovarian secretion and is a prominent indication that the tissues are favorable to the reception of the ovum?

Recently various authors have suggested a connection between abnormal conditions of the ovary or corpus luteum and aberrant developments of the ovum. Thus several cases have been described in which hydatidiform mole has been associated with disease in the ovary, especially cystic degeneration. Pick has recently made a careful study of a case in which excessive production of lutein tissue was found in the ovaries, and he regarded this condition as the cause of excessive chorionic development, leading to the formation of hydatidiform mole. In chorio-epithelioma this author, Runge, and Jaffé have also described excessive production of lutein cells in the ovary, which they are inclined to consider as the cause of the chorionic growth. In several specimens of ovaries examined by Pick, Stoeckel, Runge, and others, in addition to cystic changes in Graafian follicles and corpora lutea, collections of lutein cells were found scattered through the ovarian stroma. Careful study of a larger series of ovaries must be made before any positive statement can be given in regard to the association of changes in them with abnormal development of the ovum. It is certainly difficult to explain the occurrence of hydatidiform mole in a twin pregnancy by the lutein secretion hypothesis. If overproduction of the latter be the sole cause, it is strange that both ova should not be similarly affected.

THE BLADDER.

The empty bladder lies normally below the level of the pelvic brim, behind the pubes. When relaxed (in diastole) the upper surface is concave. On vertical mesial section the slit of the cavity forms with the urethra a < shape, the anterior limb being longer than the posterior. The bladder in this condition may be described as having an upper surface in relation to the uterus; an anterior, in relation to the pubes; and a posterior, in relation to the vagina and cervix.

When empty and contracted (in systole), the bladder, on vertical mesial section, is oval in shape, its walls being thick and its mucosa wrinkled. The slit of the cavity is a single curved one, its concavity looking forward. When moderately filled, the bladder is rounded on vertical mesial section, its upper surface being somewhat above the brim level. In this state the widest diameter is the transverse. (In the male this is the narrowest.) The average capacity is about a pint when moderately filled, though much more can be held in the distended condition.

When distended, it becomes egg-shaped, its larger end being lowermost in

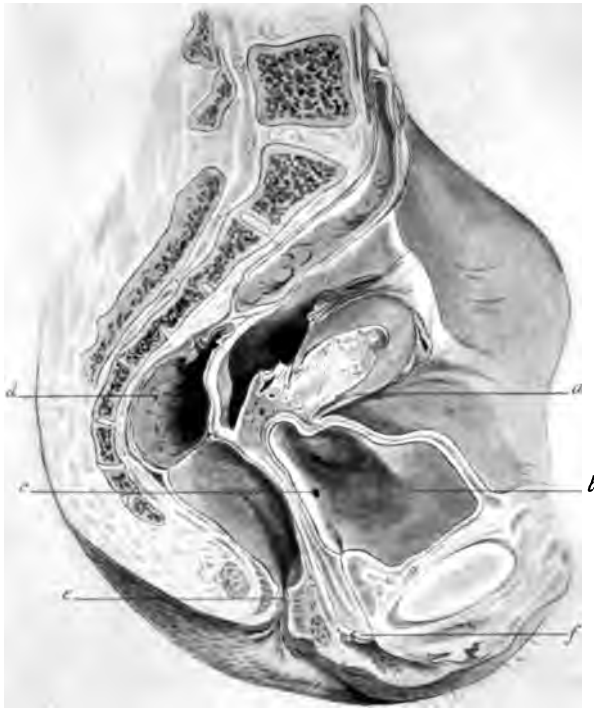


Fig. 36.—Vertical mesial section of nullipara: *a*, Uterus drawn to left of pelvis; *b*, bladder; *c*, left ureteric orifice; *d*, rectum; *e*, anus; *f*, hymen (Sellheim).

relation with the anterior vaginal wall, the smaller end or summit resting against the anterior abdominal wall. That part of the bladder which joins the urethra is sometimes termed the cervix or neck. Its long axis varies according to the degree of distention, as well as according to the condition of neighboring viscera. In the distended condition the longest axis is usually the vertical, though sometimes it is the transverse. Distention may take place until the fundus reaches the umbilicus. In this state it sinks somewhat in the pelvis, unless prevented by some special pelvic condition.

The female bladder, according to Luschka and Henle, is naturally of

smaller capacity than that of the male. Usually the former is thought to be greater, but this view is probably derived from the fact that the bladder is not infrequently found enlarged in women as the result of overdistention.

The superior surface is covered with peritoneum, and is in relation to the uterus. The reflections of the peritoneum from the bladder form folds known as the false ligaments. The summit is connected to the abdominal wall by a mesial cord, the urachus—the remains of the stalk of the allantois. This is composed of fibrous tissue, but contains some nonstriped muscle in its lower portion near the bladder. Sometimes the urachus has a central lumen which

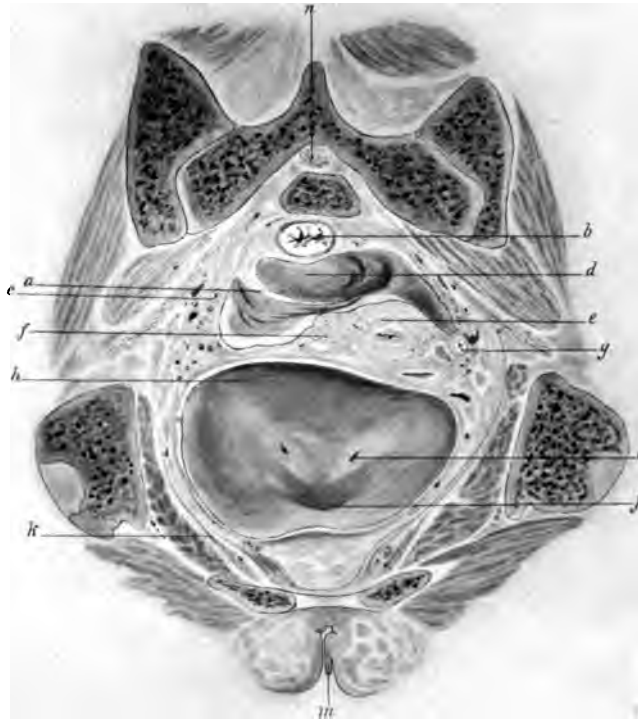


Fig. 37.—Transverse section of pelvis of multipara: *a*, Right uterosacral ligament; *b*, rectum; *c*, right ureter; *d*, pouch of Douglas; *e*, uterus drawn to left; *f*, right uterine vessels; *g*, left ureter; *h*, bladder cavity; *i*, ureteral orifice; *j*, internal urethral orifice (Sellheim).

may or may not communicate with the vesical cavity. Cysts sometimes develop in connection with it.

When the bladder becomes overdistended, it rises faster than does the peritoneum of the anterior abdominal wall, so that a pouch is formed between the bladder and the wall. In the greatest distention the peritoneum may be stripped from the parietes as much as two inches above the pubes.

The lateral limit of the superior surface is formed by the obliterated cord of the hypogastric artery, which is connected posteriorly with the superior

vesical artery, and runs forward and upward to the umbilicus. Below this cord the bladder is in relation to loose paravesical connective tissue, and to the reflection of the visceral layer of the pelvic fascia, which forms the lateral true ligament of the bladder. The anterior surface is normally in relation to the pubes. Occasionally its upper end rests just above the bone. The loose areolar tissue between the bladder and the symphysis is sometimes called the space of Retzius. In it are found strong reflections of the visceral fascia from the back of the pubic bones, termed the *anterior true ligaments*.

The posterior surface is in relation to the cervix uteri and the upper part of the vagina. There is loose cellular tissue between them. This surface is also called the base of the bladder. It does not reach so far back as in the male.

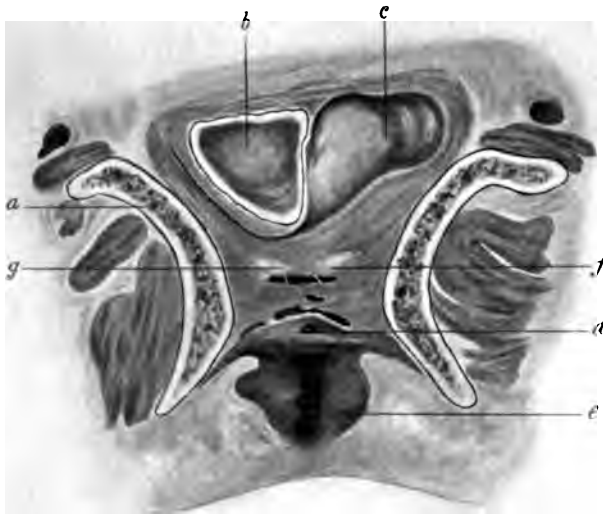


Fig. 38.—Coronal section through pelvis on sixth day of puerperium: *a*, Ramus of pubes immediately behind symphysis; *b*, right half of fundus uteri; *c*, bladder; *d*, urethra; *e*, vagina; *f*, *g*, anterior true ligaments of bladder.

The bladder is generally situated mesially, but it is often found slightly more to one side than to the other. In the erect position the opening of the urethra is the lowest part of the bladder. It is usually about one inch behind the middle of the symphysis pubis.

Ligaments of the Bladder.—The bladder is supported mainly by reflections of the visceral pelvic fascia. These are usually described as the *true ligaments*, two being *anterior* and two *lateral*. They are fully considered in the description of the pelvic fascia (see p. 93).

The peritoneal folds, termed *false ligaments*, are of little importance in supporting the bladder. There are five of these:

One *superior*, a mesial reflection from the summit of the bladder to the anterior parietes.

Two lateral, formed by the reflection, on each side, of the peritoneum over the obliterated hypogastric arteries.

Two posterior folds, uterovesical, passing between the bladder and uterus, being very short.

Structure.—The serous or peritoneal layer which partially covers the upper and posterior surfaces of the bladder has already been described.

The musculature is composed of nonstriated bundles, and is usually described in three layers:

1. *Outer Longitudinal Layer.*—This is most developed on the anterior and posterior surfaces; laterally the fibers run somewhat obliquely and intersect.



Fig. 39.—Coronal section through pelvis on sixth day of puerperium: *a*, Ascending ramus of pubes; *b*, descending ramus; *c*, obturator muscle; *d*, uterus; *e*, bladder; *f*, vagina; *g*, urethra.

This layer forms what is generally known as the *detrusor urinæ* muscle. Griffiths, however, states that it is not a separate muscle nor has it a separate function.

2. *Middle Layer.*—This is thin and irregularly developed. The fibers run more or less transversely, especially in the lower third of the bladder; in the upper part somewhat obliquely. The bundles are frequently somewhat reticulated. At the opening of the urethra the transversely or circularly running fibers are believed to form a distinct *sphincter vesicæ*. Griffiths states that there is no special thickening of the muscle to form a true sphincter.

3. *Inner Layer*.—This is a thin layer whose bundles are reticulated, though the general direction may be said to be longitudinal. Ellis, who first described the layer, named it “submucous.”

From the arrangement of the musculature it is evident that the wall varies in thickness, owing to the reticulations. Sometimes, as the result of distention, marked thinning may be brought about at one or more areas, and through these there may be a protrusion of the mucosa. Such a bladder is termed “sacculated.” In some cases of hypertrophy the ridges of the fasciculi may become more prominent, a condition termed “*fasciculated bladder*.”

Internal to the musculature, except at the trigone, is a layer of loose connective tissue containing elastic fibers—the *submucous layer*.

The mucous membrane is pale pink in color, soft, and rugose, save when the bladder is distended. It is loosely attached to the muscular part of the wall, except at the trigone. It is lined with stratified transitional epithelium,



Fig. 40.—Vertical mesial section of female pelvic floor, showing contracted empty bladder: a, Bladder (Braune).

like that of the ureter, the cells varying in appearance according to the state of the bladder; in the distended condition they are somewhat flattened out. The rugosities of the wall of the empty bladder are due to the wrinkling of the mucosa and also to the reticular elevation or ridges formed by underlying muscular fasciculi.

The internal urethral orifice is a transverse slit. Extending from it the vesical mucosa is very slightly ridged longitudinally. Immediately behind it is the trigone (*trigonum vesicæ* vel *Lieutaudii*), a triangular surface lying between the urethral and ureteral orifices. The mucosa of this area is smooth, being connected to the muscular coat by dense, firm connective tissue. When the bladder is filled, the sides of the trigone are about $1\frac{1}{8}$ inches in length; its area is diminished when the bladder is empty. It is smaller in the female than in the male.

The ureteral orifices are oval slits, and are directed forward and inward.

Each is situated on a slight elevation—mons ureteris. Between them the bladder mucosa is slightly raised in a curved ridge, the convexity looking forward. It is due to a submucous muscular band, which joins the ureters and binds them to the bladder. The ridge usually runs outward and backward from the ureteral orifices for a short distance. From the middle of this ridge a slight elevation sometimes projects forward—the uvula vesicæ. This is very poorly developed in the female.

Note.—In infancy the main portion of the bladder lies above the symphysis. It gradually sinks as the child grows, partly owing to its weight, to the erect position of the body, and to the increasing width of the pelvis. In a child of six Symington found the bladder still partly abdominal.

THE URETHRA.

The urethra is about $1\frac{1}{2}$ inches in length, and is directed from the bladder downward and forward parallel to the vagina, sometimes with a slight sigmoid curve. Its anterior and posterior walls are in apposition, save during micturition. The width of the closed tube is about $\frac{1}{4}$ inch. The external orifice in the nullipara is usually a vertical, triradiate slit opening on a slight elevation, situated in the middle line in front of the hymen.

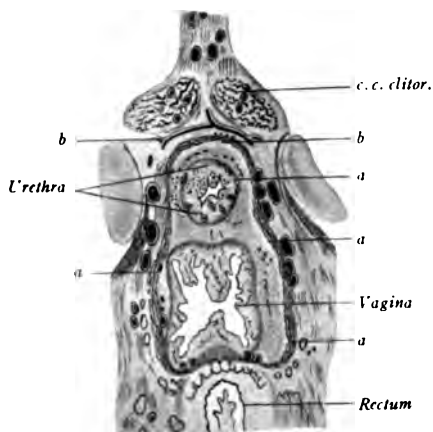


Fig. 41.—Section showing relationships of urethra (Tschaussow).

The elevation may present various shapes. It may be divided into two or more ridges or may be entirely absent. Williamson states that it is most frequently a two-horned crescent occupying the posterior half of the meatus.

On stretching the vestibule transversely, the meatus becomes transversely crescentic, the concavity being directed backward.

According to Williamson, the canal is fusiform. The narrowest part is at the meatus.

The muscular part of the wall consists of smooth and striped layers.

The smooth muscle consists of an outer circular and an inner longitudinal layer, separated by a considerable amount of connective and elastic tissue. There is a rich vascular arrangement, so abundant that some have given the name of corpus spongiosum urethræ to this portion of the wall.

The striped muscle lies external to the smooth layer, but is not evenly distributed. It is found mainly in a circular bundle—internal sphincter—around the upper end of the urethra; a similar arrangement exists at the lower end; it is embraced by the anterior fibers of the sphincter vaginæ, from which it may be derived.

The mucosa is raised in longitudinal folds, one being especially marked

mesially on the posterior wall—the so-called crista urethralis. The epithelial lining in the upper part is like the transitional epithelium of the bladder. Toward the lower portion the arrangement is similar to the epithelial layer of the vestibule. Under the epithelium is loose connective tissue and elastic fibers richly vascularized. On the mucosal surface are numerous lacunæ and also acinous mucous glands, especially numerous at the lower part of the urethra. They sometimes contain, in old people, small brownish masses, like prostatic calculi in men. These glands are the homologues of the male prostatic glands;

Surrounding the meatus are a number of small openings varying in number in different cases.

Two small blind glandular ducts are usually found in the posterior wall, internal to the meatus urinarius. Sometimes they are mere crypts, sometimes

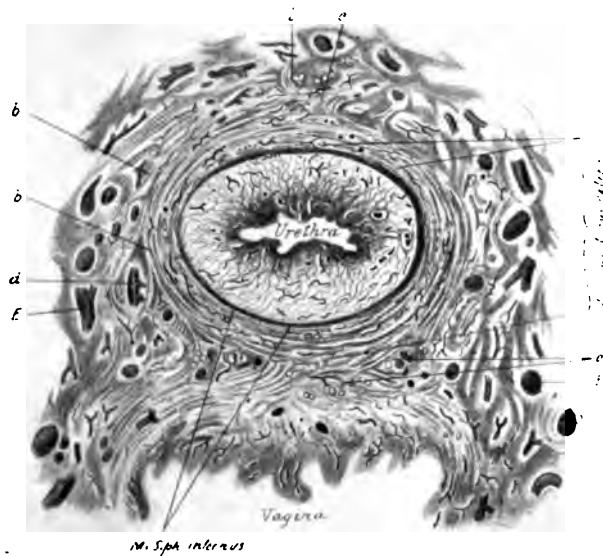


Fig. 42.—Section showing relationship of urethra (Tschaussow).

they may be $\frac{1}{2}$ inch to $\frac{3}{4}$ inch in length. They are $\frac{1}{32}$ to $\frac{1}{16}$ inch in diameter. At their upper ends they divide into branches. Sometimes they are absent; occasionally only one, rarely three, are present. There is a discussion as to the nature of these. According to Nagel, they have long been known as the paraurethral ducts, or as the ducts of Malpighi; more recently they have been known as the ducts of Skene. By some they are considered to be the remains of the lower ends of the Wolffian ducts (Gartner's canals).

Nagel denies this origin, and says that they are formed in early embryonic life as a depression of the epithelium covering the urogenital sinus, at a time when Gartner's canals have disappeared from every part save the broad ligaments.

Moreover, they may be absent in the fetus and develop later in life. The

occasional occurrence of a third duct is not in keeping with the view that they are of Wolffian origin.

Note.—The urethra is very distensible. All the folds are capable of being flattened out save the mesial one of the posterior wall.

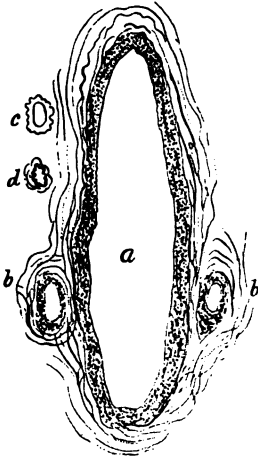


Fig. 43.—Transverse section of urethra, enlarged: *a*, Urethral canal; *b, b*, Skene's ducts; *c*, vein; *d*, artery (Skene).

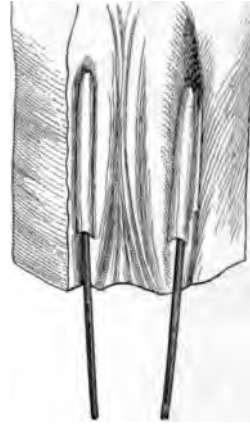


Fig. 44.—Urethra opened up, showing glands with probes passed in (Skene).

THE URETERS.

The ureters extend from the sinus of the kidney to the bladder. Their upper ends are enlarged to form the pelvis of the kidney. From the lower end of the pelvis downward the ureter is a simple cylindric duct flattened from before backward. The whole length is about 12 inches; it may, however, be somewhat longer or shorter than this. The abdominal portion is about 1 inch longer than the pelvic portion. The width of the lumen below the renal pelvis is about 3 mm. save at the junction with the bladder, where it is narrower. It runs downward and inward on the psoas muscle, under the peritoneum, toward the brim of the pelvis. The right ureter lies close to the inferior vena cava, being sometimes in front of it. At the brim it lies in the hollow at the side of the promontory, about $1\frac{1}{4}$ inches from the middle line. It crosses either the common iliac or the external iliac vessels and lies in the space between the latter and the internal iliac or behind the internal iliac, and is directed downward and forward, lying against the pelvic wall, covered by the peritoneum continuous with the posterior layer of the broad ligament. At the level where the uterine artery begins to curve inward, the ureter leaves the pelvic wall.

Here the uterine artery, which has in its upper part passed external to the ureter, now arches in front of it, being separated from it by a space 1 cm. ($\frac{2}{5}$ in.) wide, filled with a venous plexus. The ureter curves in toward the cervix, approaching to within a distance of 0.8 to 2 cm. from its lower portion. It then

passes in front of the uterus toward the base of the bladder. Opposite the lateral fornix it is separated from the vagina by a distance of 1 cm., being surrounded by richly vascular tissue. From a point opposite the lower part of the cervix it extends forward and downward between the vagina and posterior wall of the bladder for a distance of 2 to 2.5 cm., when it enters the bladder base and runs forward and inward obliquely through its wall for a distance of 1.3 cm.

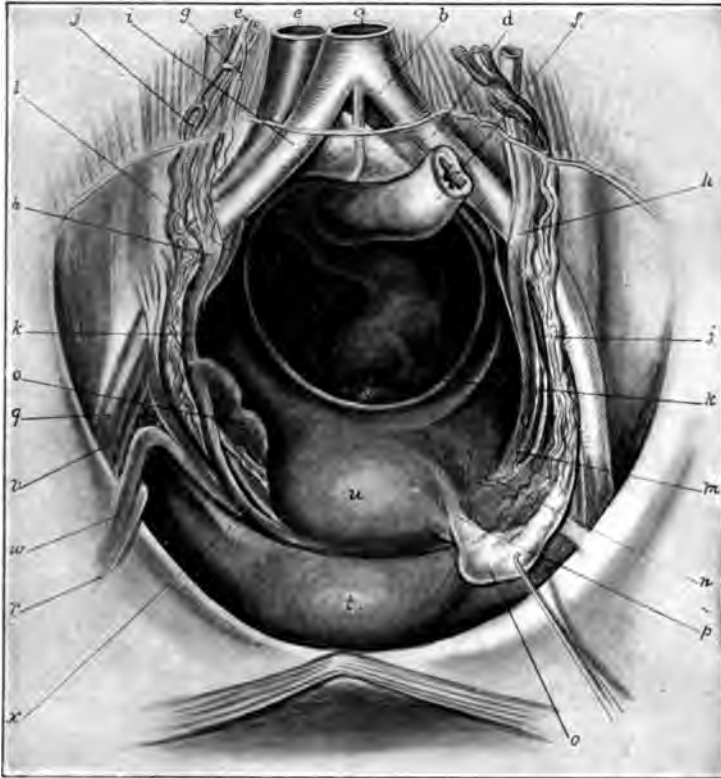


Fig. 45.—The anatomic relations of the ureter in the female: *a*, Aorta; *b*, median sacral artery; *c*, inferior vena cava; *d*, common iliac artery; *e*, ovarian artery; *f*, colon; *g*, superior ureteric artery; *h, h*, ureters; *i*, common iliac artery; *j, j*, internal ovarian venous plexus; *k, k*, right and left uterosacral ligaments; *l*, hypogastric artery; *m*, inferior ureteric artery; *n*, uterine artery; *o, o*, ovary; *p*, ovarian ligament; *q*, external iliac artery; *r*, epigastric artery; *s*, vaginal portion of the cervix uteri; *t*, bladder; *u*, uterus; *v*, external iliac vein; *w*, round ligament; *x*, Fallopian tube (Tandler and Halban).

The width between the ureters opposite their point of crossing of the cervix varies from $2\frac{1}{8}$ to $3\frac{1}{8}$ inches (7.5 to 9 cm.); between their points of entrance into the bladder, $1\frac{1}{8}$ inches (4 cm.); between the points of junction with the bladder cavity—in the empty condition, 1 inch (2.5 cm.); filled, $1\frac{3}{8}$ to 2 inches (4 to 5 cm.).

Structure.—The wall consists of an external fibrous coat; a muscular coat of three layers,—external and internal longitudinal and middle circular,—and a

mucous membrane. The mucosa is thin and has slight longitudinal folds. The epithelium is transitional, consisting of three or four rows of cells.

The connection between the ureters and the vaginal wall and between the cervix and bladder varies in different cases. Usually it is a loose one. If it be more or less firm, there will be increased danger of wounding the ureters, or of tying them in the operation of vaginal extirpation of the uterus, because they will be dragged down considerably as traction is made on the cervix. It is important, before applying the ligatures to the broad ligaments, to free the



Fig. 46.—The relations of the ureter to the uterine artery and the cervix uteri: *a, a*, Ureter; *b*, hypogastric or internal iliac artery; *c*, ovarian suspensory ligament; *d*, external iliac artery; *e*, uterosacral ligament; *f*, cervical canal; *g*, uterine artery; *h*, parametrium; *i*, vaginal branch of uterine artery; *j*, posterior wall of bladder; *k*, uterus, bisected (Tandler and Halban).

bladder from its connections with the cervix and to apply the lower ones close to the cervix.

Sampson directs particular attention to a special sheath surrounding the pelvic portion of the ureter, derived from the neighboring connective tissue; it is better developed in some cases than in others. Near the bladder, muscular fibers also enter into its formation, arising apparently from the bladder. It contains the vascular ureteral plexus.

Development of the Urinary Tract and Outer Genitals.—Nagel's description may be taken. The allantois begins as a hollow extension of the posterior end of the primitive gut.

In the young human embryo (8 to 12 mm. in length) it appears as a curved canal extending from the cloaca to the navel, completely separated below from the gut. It is lined with low cubic epithelium. The Wolffian ducts open into its posterior wall.

That part of the allantois below the Wolffian ducts forms the urogenital canal. The upper part narrows toward the navel and gets gradually solid. At this period the Müllerian tracts are in a very early stage, and are not to be found in the region of the lower ends of the Wolffian ducts. On each side the ureter is found opening into the Wolffian duct, from which it arises as an outgrowth. The junction of these two tubes forms a funnel-shaped passage, larger than either of its component parts, opening into the allantois.

From this level the Wolffian ducts pass upward and outward to the Wolffian bodies; the shorter ureters pass upward behind and external to them. Gradually, the ureter and Wolffian

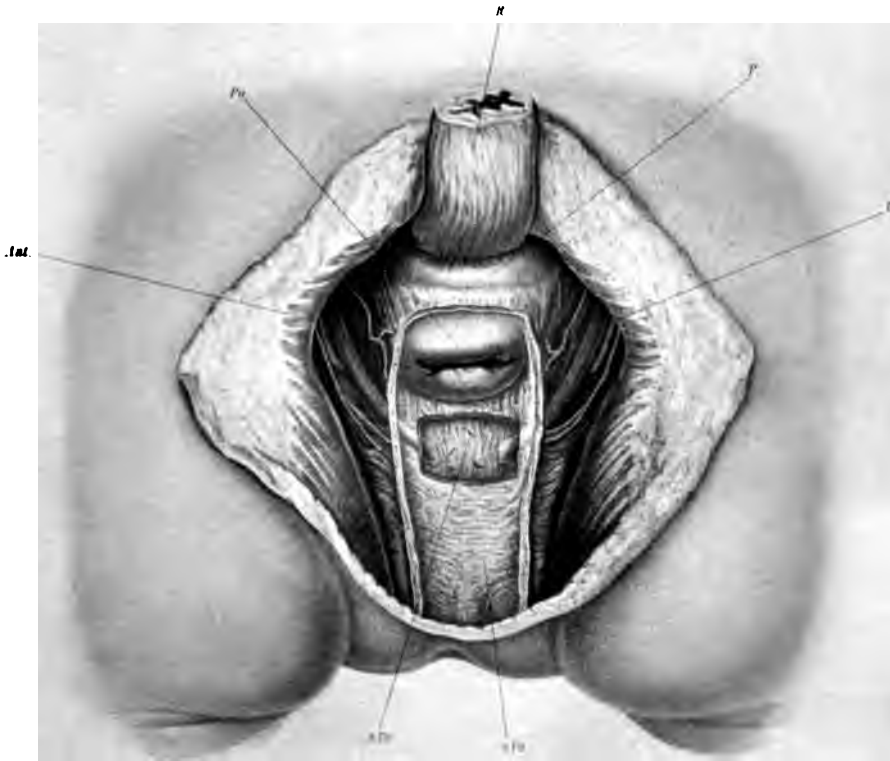


Fig. 47.—Dissection from behind showing relationships of lower ends of ureters: *A.u.*, Uterine artery; *h. Ve.*, posterior wall of bladder; *P.*, peritoneum; *Po.*, cervix; *R.*, rectum; *U.*, ureter; *p. Va.*, anterior vaginal wall (Tandler and Halban).

duct become distinctly separated at their lower ends, opening separately into the allantoic canal, the ureters being external. This occurs before the Müllerian ducts have reached the urogenital canal.

Then begins the formation of the bladder. The part of the allantois immediately above the ureters forms a short, spindle-shaped dilation. This is found, in embryos, 2.4 cm. in length. It is lined with cubic epithelium, which becomes arranged in several layers.

From the remains of the allantois above the bladder is formed the urachus. As the bladder increases in size the ureteric orifices are raised somewhat.

In the earliest human embryos observed, both Wolffian ducts and the gut open into the lower part of the allantois at about the same level. At this period the anus is closed by the anal membrane, but it soon becomes perforated. Then, through increase of the septum lying between

the Wolffian ducts and the gut, the lower part of the allantois (endodermal cloaca) is divided into two parts, of which the former gives rise to the urogenital sinus and the latter to the anus, both communicating with the ectodermal depression on a lower level—the true cloaca.

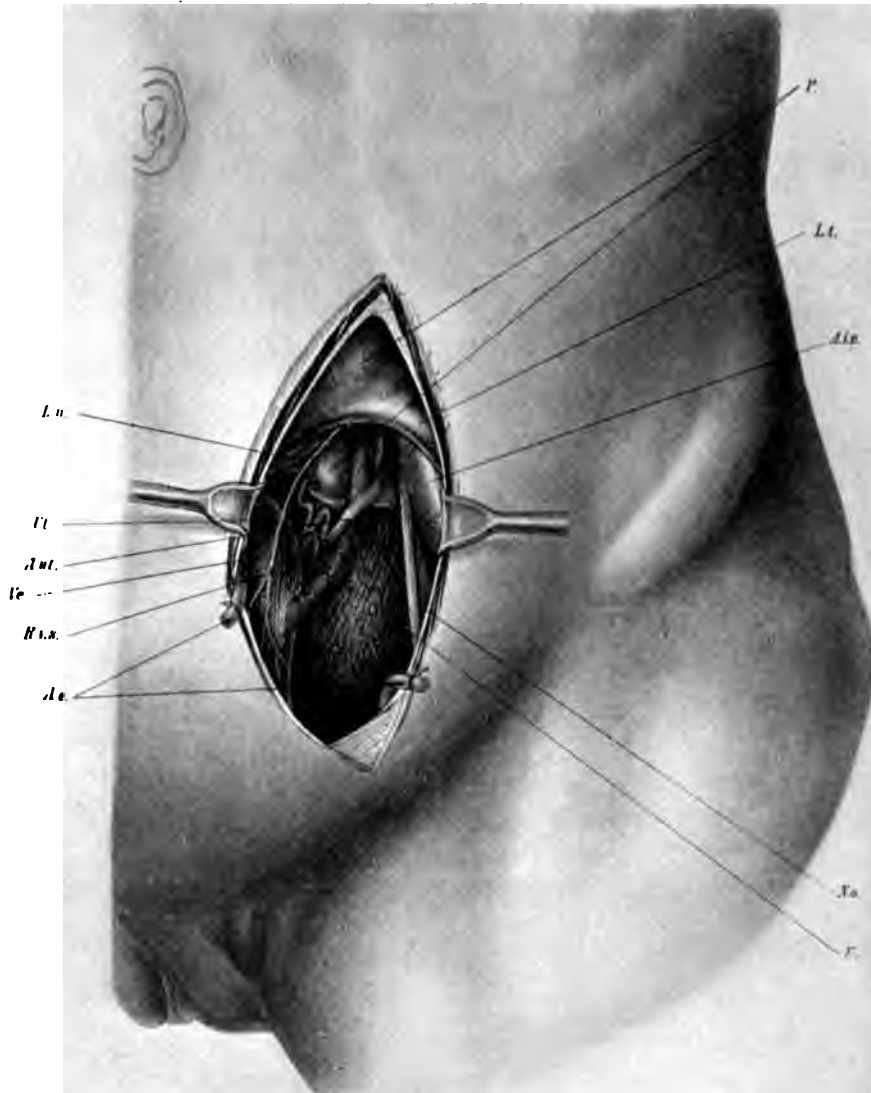


Fig. 48.—Extraperitoneal dissection through the anterior abdominal wall to expose the ureter: *Ve.*, Bladder; *U.*, uterus; *U.*, ureter; *P.*, peritoneum; *Lt.*, round ligament; *A.e.*, epigastric artery; *A.I.e.*, external iliac artery; *A.u.*, uterine artery; *N.o.*, obturator nerve; *R.v.s.*, superior vesical artery (Tandler and Halban).

If, after separation of the ureters from the Wolffian ducts, the outer surface of the embryo be studied, the cloaca is seen as an anteroposterior depression, into the posterior part of which the gut opens, and into the anterior part the urogenital canal, a septum existing between them. It is covered with stratified epithelium.

The Wolffian ducts do not open into the cloaca, it must be understood, but into the upper part of the urogenital sinus.

The anteroposterior extent of the cloaca corresponds to the adult limit between the frenum of the clitoris and the posterior anal wall in the female (between the anterior wall of the urethra and the posterior anal wall in the male).

In both sexes the sides of the anterior part of the cloaca first become blended. Gradually,

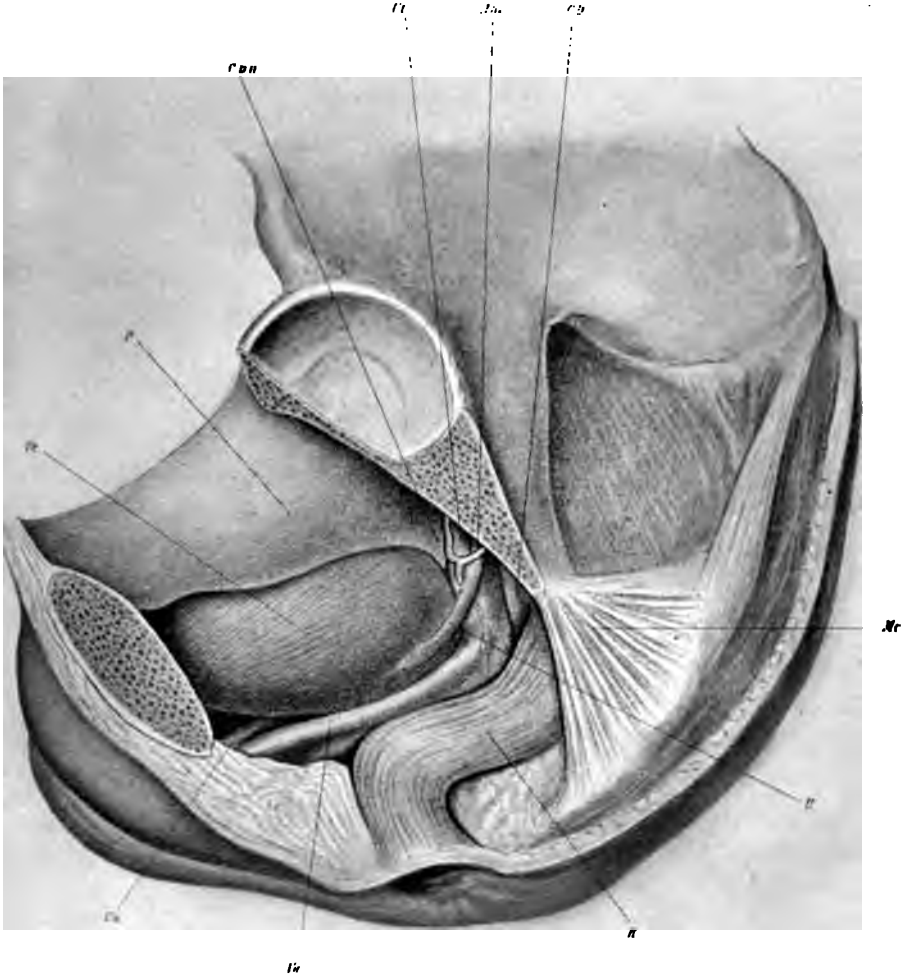


Fig. 49.—Lateral dissection showing relationships of the ureter: *A.ut.*, Uterine artery; *C.D.*, pouch of Douglas; *M.c.*, coccygeus muscle; *P.*, peritoneum; *R.*, rectum; *U.*, ureter; *U.*, urethra; *U.*, uterus; *Va.*, vagina; *Ve.*, bladder; *c. v. u.*, vesico-uterine space (Tandler and Halban).

also, bridges of epithelium extend across the cloaca so as to leave openings communicating with the passages above.

At the anterior end of the united cloaca is found a lozenge-shaped area, situated at the base of the glans, in both sexes; this disappears in males, but remains in females.

In the meanwhile the Müllerian ducts have been extending downward to the urogenital canal. This is reached in the embryo of 2.5 to 3 cm. in length. When communication is established between them, four canals, in all, open into the urogenital canal, namely, the two Wolffian

and the two Müllerian, the latter being internal to the former, but at the same level. On the posterior wall of the canal where they open a small projection is found, known as Müller's eminence. Both the Wolffian and Müllerian ducts are surrounded by a common mass of tissue, thus forming the so-called *genital cord*.

Henceforth the course of development differs in males and females. In the female the Wolffian duct disappears save in the broad ligament, where it forms the organ of Rosenmüller and other remains. In embryos of 4 cm. and upward only the Müllerian ducts are found opening into the urogenital canal. The latter and the gut only open into the cloaca at this time.

Through the development of the vagina from the lowest end of the blended Müllerian ducts, through the simultaneous shortening of the urogenital canal to form the urogenital sinus, and through the flattening of the latter to form the vestibule, the vaginal orifice is brought to the pelvic floor.

Along with the development of the vagina goes that of the urethrovaginal septum and the urethra.

Posteriorly, the perineum develops through union of both sides of the cloaca, taking place by means of an epithelial proliferation.

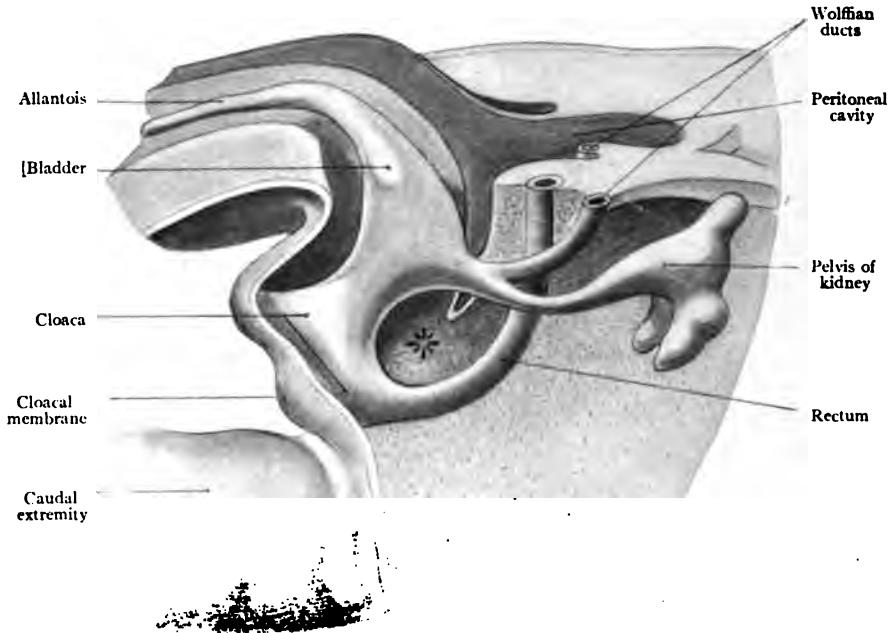


Fig. 50.—Model illustrating the relationships of the pelvic contents in an embryo 11.5 mm. in length (Keibel).

As regards the Wolffian ducts, Nagel points out that at the beginning of the development of the vagina they begin to shrink, and that thereafter, as a rule, remnants are not found below the level of the junction of the uterus and the vagina. He does not believe that they are found in adult life as low down as the urethral orifice. Before the vagina is much developed or the Wolffian ducts degenerated, the latter open into the urogenital sinus close to the *anlage* of the bladder.

If the ducts persist, they are more likely to be found in the anterior vaginal wall, opening at each side of the vaginal entrance, rather than in relation to the urethra; but no such occurrence has yet been clearly demonstrated.

Van Acheren has described a four-months' embryo, in which small canals were found in the lower part of the vagina. They could not, however, be traced to the remains of the Wolffian duct in the broad ligament, and there is no proof that they were of Wolffian origin; Nagel regards them as the *anlage* of the Bartholinian gland.

G. Klein states that he found in a girl two ducts in the lower part of the vagina leading into the hymen, the lower end of one being slightly distended.

Koerberlé has described two interesting cases, in which the relations of persistent Wolffian

ducts were clearly made out. In one of these there was a development of one horn of the uterus only, the other being rudimentary and imperforate. A persistent Wolffian duct (Gartner's canal) extended from the longitudinal tube of the organ of Rosenmüller, through the broad ligament, and obliquely down through the wall of the right cornu, entering it near the round ligament, and opening into the cavity of the uterus at the os internum.

In the other case there existed a uterus bipartitus and a vagina septa. The left half of the vagina was narrower than the right, and ended about half-way down the latter, communicating with it by a small aperture. Opening into the left half of the vagina on its outer side was a small canal which extended upward into the uterine wall—the remains of the Wolffian duct.

Dohrn has examined many specimens, but has never found traces of the duct much below the level of the vaginal fornix. Rieder has found remains in relation to the upper part of the vagina, but never near its lower end.

Nagel is inclined to believe that the condition of double ureter has been described by several writers as that of persistent Wolffian duct.

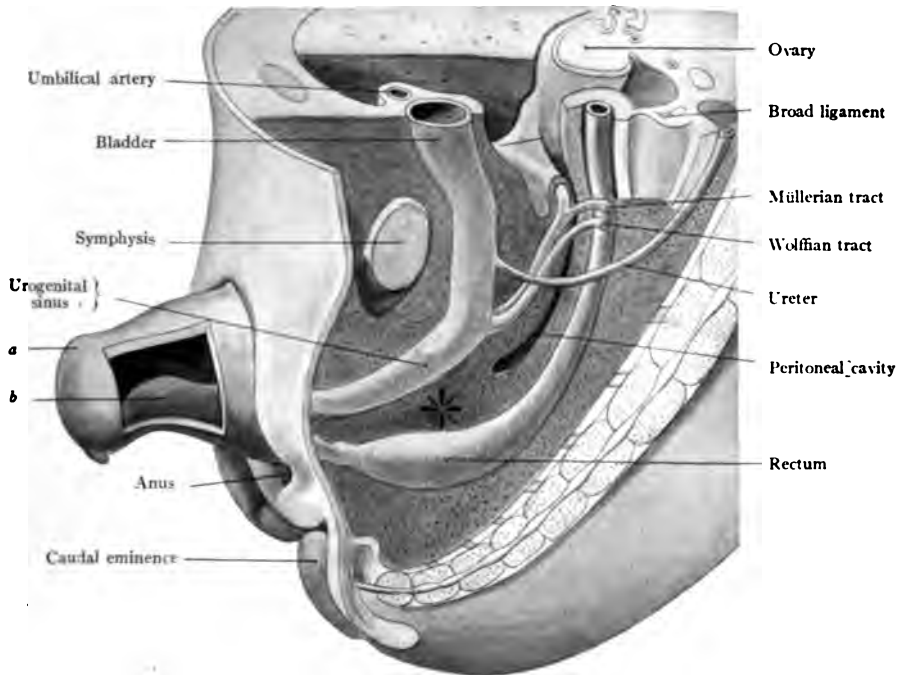


Fig. 51.—Model illustrating the condition of the urogenital tract in an embryo eight and one-half to nine weeks old: *a*, Genital eminence; *b*, urogenital sinus (Keibel).

It is, indeed, not difficult to understand why Wolffian remains should rarely be found below the cervix. After the formation of the ureters the ducts get cut off from the urogenital sinus, and, as the latter becomes shallower, its wall moves farther away from the ducts. At the same time, owing to the vertical development and extension of the vagina, the *anlage* of the cervix, at first on a level with the lower ends of the Wolffian ducts, and in very close relationship with them, is moved gradually farther away from the urogenital sinus, and with it, consequently, the Wolffian ducts are moved farther away.

It is, therefore, highly probable that the small crypts, known as Skene's or Malpighi's, or para-urethral ducts, are not derived from the Wolffian canals. According to Nagel, these ducts are formed in early embryonic life by a depression of the epithelium covering the urogenital sinus, at a time when the Wolffian ducts have disappeared from the region of the vagina and bladder.

Very strong, too, is the evidence derived from pathologic changes in the remnants of the Wolffian ducts. For a long time it has been known that the chief seat of such conditions is the broad ligament. Recently von Recklinghausen has shown, in an important monograph, that

Wolffian remains may play an important part in the formation of adenomyoma and cystic adenoma of the wall of the tube or uterus. In the twenty-eight cases carefully studied by him, twenty-three presented these pathologic conditions in the tube-wall or upper part of the corpus

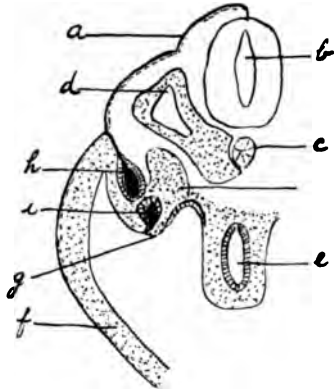


Fig. 52.—Diagram representing a transverse section across one-half of the abdomen of an early embryo, giving origin to Müllerian and Wolffian ducts: *a*, Dorsum; *b*, spinal canal; *c*, notocord; *d*, myotome; *e*, gut; *f*, somatopleure; *g*, Wolffian ridge; *h*, Wolffian duct; *i*, Müllerian duct; *j*, intermediate cell-mass (after A. Keith).

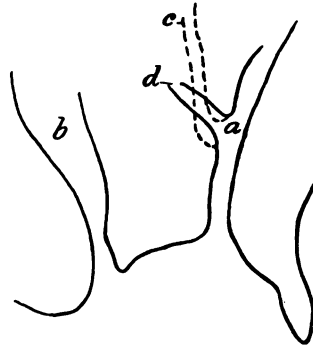


Fig. 53.—Diagram illustrating development of lower urogenital tract. The ureters and Wolffian ducts open at the same level in the urogenital canal: *a*, Urogenital canal; *b*, rectum; *c*, Wolffian ducts; *d*, ureter (after Nagel).

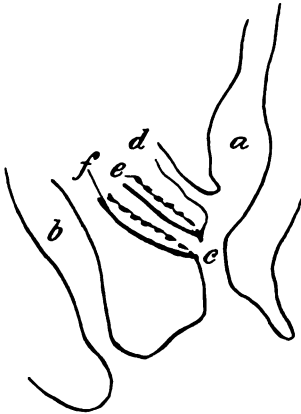


Fig. 54.—Diagram illustrating development of lower urogenital tract. The Wolffian ducts and ureters are represented as opening into the urogenital canal at different levels: *a*, Bladder; *b*, rectum; *c*, urogenital canal; *d*, ureter; *e*, Wolffian duct; *f*, Müllerian duct (after Nagel).

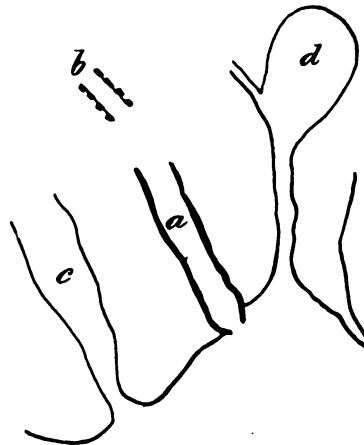


Fig. 55.—Diagram illustrating development of lower urogenital tract. The vagina (*a*) is represented well developed. Above it is a remnant of the Wolffian ducts (*b*): *c*, Rectum; *d*, bladder (after Nagel).

uteri; but only in four cases could any trace of the Wolffian ducts be found below the level of the body of the uterus, and then only in the upper part of the cervix.

Cystic conditions below the level of the cervix are very rare. In the majority of cases they are lined with a single layer of cylindric epithelium, sometimes with squamous epithelium. As to the Müllerian or Wolffian origin of these, no decision can be formed at present. Probably they are derived from both sources, most rarely from the latter.

THE RECTUM.

This part of the large intestine extends from the sigmoid flexure at the left sacro-iliac joint to the anus. The *first part*, four or five inches long, passes downward, backward, and to the right, as far as the middle of the third sacral vertebra; often this portion is displaced to the right half of the pelvis. It is covered almost completely with peritoneum, the two folds of which are attached to the sacrum as the mesorectum.

The *second part*, three or four inches long, extends down and forward to the anal canal. In its upper part it is covered with the peritoneum, reflected from the posterior vaginal wall.

Below this the bowel is in relation anteriorly to the posterior vaginal wall. Its posterior wall is in relation to the sacrum, coccyx, and the anococcygeal body.

Structure.—The muscular wall is thick and consists of external longitudinal and circular layers. The former extends all around the bowel, but is mainly aggregated in two bundles—an anterior and a posterior. The shortness of these leads to the sacculations found in the rectum.

The circular fibers are especially collected in thick bundles between the sacculations.

In addition, a small pair of muscles arise from the front of the second and third coccygeal vertebræ and pelvic fascia, and pass down to the posterior part of the anal canal, mingling with the longitudinal fibers. They are the rectococcygeal muscles.

The **mucous membrane** is loosely connected to the muscular coat. When the rectum is empty and contracted, it presents numerous folds, most of which are obliterated when the bowel is distended. Some are permanent and are known as “valves” of the rectum or “*plicæ recti*.” The largest is on the right side opposite the reflection of the peritoneum, the *plica transversalis recti*. On the left side, an inch above this, is another; and an inch below another, on the left side. The lower two folds together form a partial closure of the bowel, easily distinguishable by the examining finger. This sphincter-like arrangement has been called the “third sphincter of the anus.”

The dilation of the bowel below this valve is called the *ampulla* of the rectum.

The **anal canal** is the terminal portion of the rectum, surrounded by sphincters. It is an anteroposterior slit in the pelvic floor when closed, and is thus to be distinguished from the lower part of the rectum, which is a trans-

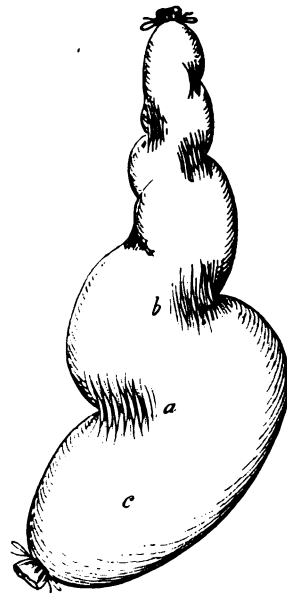


Fig. 56.—Rectum inflated: *a, b*, Sphincter tertius; *c*, ampulla of rectum (Chadwick).

verse slit. It is an inch long in the empty condition of the rectum, shorter when the latter is loaded. It is directed downward and backward, and is related behind to the anococcygeal body; at the sides, to the ischiorectal fat; in front, to the perineum.

Its mucous membrane is arranged in four or five longitudinal folds, the columns of the rectum.

The muscles which close the anal canal are the *external* and *internal sphincters* and the *levator ani*.

The external sphincter is elliptic in form, and is placed beneath the skin around the margin of the anus.

The internal sphincter is continuous with the circular fibers of the rectum. It is composed of nonstriped muscle and surrounds the whole anus.

The levatores ani are described on p. 95.

The mucosa of the rectum and greater part of the anal canal is lined with columnar epithelium, and contains follicles of Lieberkühn closely arranged.

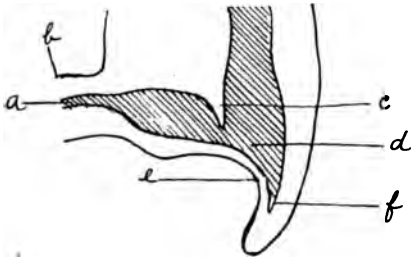


Fig. 57.—Diagram illustrating beginning of division of cloaca into rectal and urogenital tracts in embryo of third week: *a*, Allantois; *b*, umbilical cord; *c*, septum; *d*, cloaca; *e*, cloacal membrane; *f*, lowest part of cloaca in tail region.

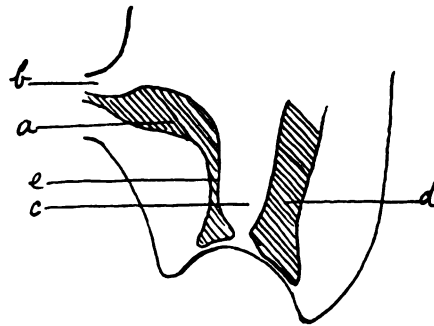


Fig. 58.—Diagram illustrating complete division of cloaca in embryo of fifth week: *a*, Bladder; *b*, umbilical cord; *c*, septum which has divided cloaca; *d*, rectum; *e*, urogenital sinus.

A narrow zone of the anus internal to the skin has no follicles. Its mucosa gradually changes into a skin-like character toward the margin of the anus.

THE PELVIC PERITONEUM.

As the peritoneum descends from the posterior abdominal wall, it covers the first part of the rectum, forming a *mesorectum*, which is attached to the sacrum.

Gradually it leaves the gut posteriorly, then laterally, and then the anterior surface of the second portion of the rectum, being reflected on the posterior vaginal wall, $\frac{1}{2}$ to $\frac{3}{4}$ inch below the attachment of the latter to the uterus. It then spreads over the fundus of the uterus down its anterior wall, and at the level of the isthmus is reflected to the superior surface of the bladder, and then to the back of the upper part of the symphysis. At each side of the bladder it leaves that viscus along the line of the obliterated hypogastric artery, and passes to the pelvic wall.

From each lateral edge of the uterus the peritoneum extends out as, a double layer—the *broad ligament*—to the side wall of the pelvis.

The Broad Ligaments.—Each one extends from the uterus to the side wall of the pelvis, in front of the sacro-iliac joint, slightly behind the level of the transverse pelvic diameter.

The folds are close together in the main extent of the ligaments, but toward their base and toward their outer part they separate somewhat, there being more connective tissue in those portions. The upper free border is occupied in most of its extent by the Fallopian tube. The fold of the broad ligament belonging to the tube is often termed the *mesosalpinx*.

They contain mainly connective tissue. In their lower parts is found a thin layer of smooth muscular fibers, continuous with those of the outer layer of the uterus and bladder. In the upper portions very few muscular fibers are found; here the layers of the ligament can be easily moved on one another.

The portion outside the tube incloses the ovarian vessels and extends above the pelvic brim as the *suspensory ligament* (infundibulopelvic) of the ovary. Between the ovary and the uterus is a fold of the posterior layer forming the *ovarian* or *utero-ovarian ligament* (see p. 48). A fold of the anterior layer is also seen passing from the angle of the body of the uterus and inclosing the *round ligament* of the uterus (see p. 32). Projecting from the posterior surface is the ovary (see p. 47). Sometimes the ovary is sessile; sometimes the portion of the broad ligament to which it is attached is more or less elongated into a kind of pedicle, termed the *mesovarium*. Within the folds of the ligament are the remains of the Wolffian body and duct, besides vessels, nerves, etc.

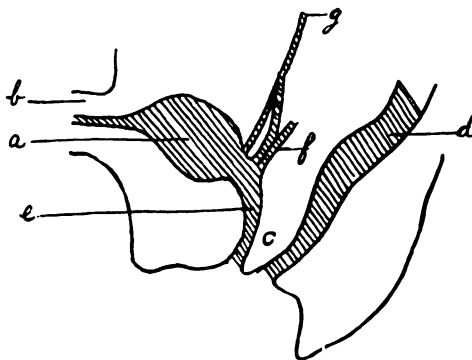


Fig. 59.—Diagram illustrating relationships of Müllerian and Wolffian ducts in the embryo at beginning of third month: *a*, Bladder; *b*, umbilical cord; *c*, septum dividing urogenital sinus from rectum; *d*, rectum; *e*, urogenital sinus; *f*, left Müllerian duct; *g*, right Wolffian duct.

The position of the broad ligament varies according to that of the uterus, as well as according to different conditions of intra-abdominal pressure.

When the uterine body lies on the empty bladder, the inner part of the ligament is bent downward and forward. If there is a sharp flexion on the uterus, there is a corresponding fold across the ligament.

The portion attached to the outer end of the tube is quite movable, and may often be found folded over the ovary. The fimbriated end of the tube is therefore capable of a considerable range of movement; sometimes it may be found as far back as the rectum.

The rectovaginal pouch, or pouch of Douglas, is the depression of peritoneum between the supravaginal portion of the uterus and the upper part of the vagina in front and the second part of the rectum behind. Laterally, the upper boundaries are best described as the uterosacral ligaments. The pouch

is often deeper on the left than on the right side. This is the lowest part of the peritoneal cavity in the erect posture. Normally the intestines do not descend into the pouch. Sometimes the latter dips abnormally low into the perineal body. Sometimes it is rather high, near the top of the fornix.

The **utero-vesical pouch** is that between the uterus and bladder, bounded laterally by the utero-vesical folds (false ligaments) of peritoneum. Normally, no intestines lie in this pouch. In the retroverted condition of the uterus they are, however, found there.

Development of Broad Ligaments.—Each arises from an upgrowth of the epithelial covering and subjacent tissue of the Wolffian body in the shape of a fold.

CONNECTIVE TISSUE OF THE PELVIS.

Under this heading must be noted—(1) The denser fascial layers known as the *pelvic fascia*, of importance in relation to the support of organs and to the strengthening of the pelvic floor; (2) the loose connective tissue between the various layers of the former, between muscles and surrounding bladder, urethra, vagina, and rectum, of importance in relation to inflammation. The first of these has received scant attention at the hands of gynecologists. I have given it a prominent place in the consideration of the nature of the pelvic floor, as I believe this necessary to establish a correct understanding of this important structure (see p. 92).

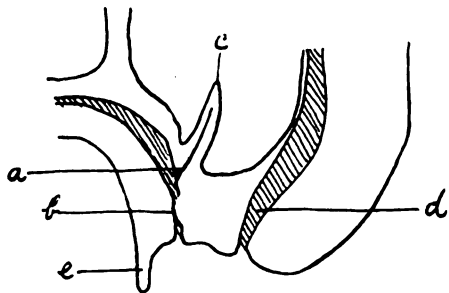


Fig. 60.—Diagram illustrating pelvic relationships in an embryo of the fourth month: *a*, Vagina; *b*, urogenital canal; *c*, uterus; *d*, rectum; *e*, clitoris.

The loose connective tissue to which reference must be made is found in the broad (lateral parametric) and uterosacral ligaments (posterior parametric), at the sides of the bladder (paravesical), around the rectum (paraproctal), between the bladder and the cervix, on the side wall of the pelvis, in the round ligaments, around the upper portion of the vagina (paravaginal).

Most important of these, as regards the frequency of inflammation in them, are the broad and uterosacral ligaments.

This ligamentous and visceral cellular tissue is continuous with that on the pelvic wall and the latter with that in the thighs, through the inguinal and femoral canals, and with that in the buttocks by the sciatic foramina. The cellular tissue in the ischio-rectal fossa lies below the fascia covering the lower surface of the levatores ani.

RELICS OF THE MESONEPHROS OR WOLFFIAN BODY IN THE BROAD LIGAMENTS.

In their very full account of these relics Ballantyne and Williams have pointed out the unfortunate confusion in the nomenclature employed in their description. I shall employ their terminology.

Organ of Rosenmüller.*—In the adult this is a triangular or trapezoid mass of tubules, situated in the broad ligament between the ovary and Fallopian tube, anterior to the ovarian vessels. It consists of a basal longitudinal duct, the remnant of the upper third of the Wolffian duct, known as the duct of Gartner, situated close to the Fallopian tube, and of a number of tubules extending downward from the longitudinal duct toward the hilum of the ovary. The duct of Gartner usually terminates externally in a small cyst, sessile or pedunculated, known as the hydatid of Morgagni; its inner end approaches the uterus, where it usually ends. Its wall consists of fibrous tissue and a few smooth muscular fibers. It contains a lumen, lined with columnar epithelium, nonciliated. In the lumen cell debris may be found. The vertical tubules may be divided into an inner and an outer group. The former, twelve or more in number, mostly reach the hilum of the ovary, though some fall short of it. They run toward the ovary, being slightly tortuous in their upper part, and appear to end in a small area, called by Rosenmüller the *locus obscurior*. On microscopic examination this area is composed of a network of the tubules—the rete ovarii—some of which enter the ovary. The outer tubules, four or five in number, run curved courses downward and inward, not reaching the ovary; they are known as the tubules of Kobelt, and may give rise to small cysts.

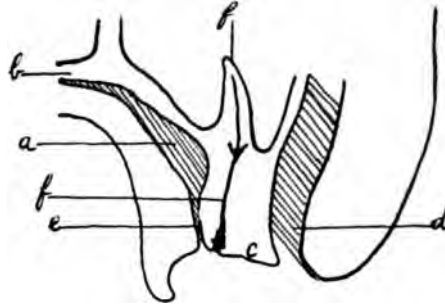


Fig. 61.—Diagram illustrating pelvic relationships in a fifth-month embryo: *a*, Bladder; *b*, umbilical cord; *c*, perineum; *d*, rectum; *e*, urethra; *f*, vagina.

The walls of the vertical tubules are made up of connective tissue and a little smooth muscle. Few of them contain a lumen. When this exists, it is lined with columnar epithelium in its upper portion and by cubic epithelium near the ovary, the latter being often ciliated. In the outer group of tubules the lining cells are usually cubic.



Fig. 62.—Diagram illustrating relationships of tube, ovary, and Wolffian remains in the adult.

In the fetus and child the vertical tubes are much convoluted in their upper portions. The outer group do not reach the ovary, but end below in a

sac-like projection of the anterior layer of the broad ligament—the *corpusculum sacciiforme* of Rosenmüller; small cysts may be sometimes found. The whole mass appears yellowish gray by transmitted light. The vertical

* This term was introduced by Valentin. Synonymous with it is the name of *corpus pampiniiforme*, used by Wrisberg, *corpus conicum* of Rosenmüller, *parovarium* of Kobelt, *epoöphoron* of Waldeyer.

tubes have a lumen lined with columnar epithelium in most cases. Between the tubules small yellowish-gray masses may often be seen—also mesonephric relics. Toward adult life atrophy of the tubules takes place from within outward, and from below upward.

After the menopause the organ atrophies, the vertical tubules become shortened, straighter, and tend to disappear.

Other Relics.—Between the organ of Rosenmüller and the uterus small gray opaque areas* are found, varying in size from a millet-seed to a pea. They may also be found between the duct of Gartner and the Fallopian tube, and in some cases may be closely attached to the wall of the latter. (In the child they may also be seen between the vertical tubules.) Some of these masses are fibrous or fibrofatty, with traces of tubule remains, in the shape of canaliculi or lumina filled with epithelium; others consist of small tubules lined with nonciliated columnar epithelium.

These isolated masses are probably mainly derived from the glomeruli of the primitive kidney.

Origin of these Relics.—They are derived from the Wolffian body or mesonephros, composed of an upper or sexual part, and a lower or urinary part. Ballantyne and Williams tabulate the various parts as follows, giving also the male homologues:

FETUS.	ADULT FEMALE.	ADULT MALE.
1. Upper part of Wolffian duct.	1. Horizontal duct, duct of Gartner, or duct of epoöphoron.	1. Canal of epididymis testis.
	2. Efferent canals of epoöphoron.	2. Vasa efferentia.
	3. Tubular network, rete ovarii, locus obscurior.	3. Rete testis.
2. Sexual part of mesonephros.	4. Masses of epithelial cells in the hilum of the ovary (medullary cords of Waldeyer).	4. Tubuli seminiferi testis.
	5. Isolated tubular relics.	5. Vas aberrans Halleri.
3. Urinary part of mesonephros.	6. Isolated solid relics in broad ligament.	6. Organ of Giralddès (paradidymis of Waldeyer; parepididymis of Henle).

BLOOD-VESSELS, LYMPHATICS, NERVES.

ARTERIES.

The ovarian arteries (named "spermatic" in the male) sometimes arise from the aorta, close to the renal arteries. Sometimes the artery on one side may spring from the renal artery, rarely from the suprarenal. Occasionally both arise from a single trunk. Rarely, two ovarian arteries (sometimes three) may be found on one side. Each extends down the posterior wall of the abdomen, behind the peritoneum, on the inner aspect of the psoas muscle. The right artery crosses the inferior vena cava obliquely, and passes to the outer side of the ureter above the common iliac artery. The left artery crosses the ureter near the renal artery, and descends with the corresponding vein external to the ureter. A small branch is given to each ureter above

*To these Waldeyer applies the term *paroöphoron* or *parovarium*.

the brim of the pelvis. At the pelvic brim it enters the upper part of the infundibulopelvic border of the broad ligament, and runs tortuously in the latter, below the ovary, through the utero-ovarian ligament, where it anastomoses with the uterine artery.

Several tortuous branches run to the ovary, the outermost of which is the largest. As the main vessel runs through the utero-ovarian ligament it gives off a branch which divides into two; one of these, the inner, runs to the round ligament; the outer extends outward parallel to the tube, anastomosing with the outermost branch of the ovarian artery. From this horizontal vessel several vertical branches pass to the tube, in which they anastomose.

The explanation of the great length of these arteries is the distance through which the ovaries move. In early life they are near the kidneys. Afterward they descend into the pelvis, their vessels elongating accordingly.

The Uterine Arteries.—These arise from the anterior divisions of the internal iliacs. Each passes downward and inward through the broad ligament toward the cervix, near which it passes in front of the ureter. When it

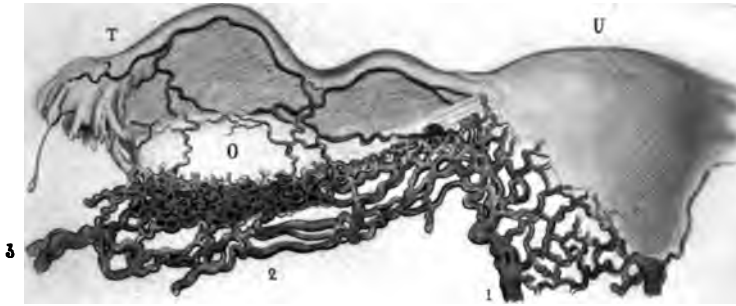


Fig. 63.—Separate view of bulb of the ovary with its venous connections: 1, Uterine vein and plexus; 2, subovarian venous plexus; 3, commencement of spermatic veins, the left opening into the left renal vein; O, ovary; T, Fallopian tube; U, uterus, its seromuscular platysma partly removed to show the veins (Savage).

crosses the latter it divides into two branches. One of these—the cervico-vaginal branch—breaks up into small twigs and supplies the cervix, sending divisions down the upper part of the vaginal walls. The other and larger branch winds tortuously up the side of the uterus as far as the Fallopian tube, where it divides into three parts, the upper of which runs along the whole length of the tube, the lower anastomosing with the ovarian artery, and the remaining branch being distributed to the fundus; in this way a considerable arterial network is formed in the broad ligament near the angle of the uterus.

Small tortuous branches pass transversely from the main ascending branch of the uterine artery, entering the upper part of the cervix and the entire length of the corpus uteri. The twigs which penetrate the muscular part of the wall run more or less at right angles to the long axis of the uterus. An anastomosis takes place between the vessels of opposite sides. Clark has shown that when one uterine artery is injected the fluid escapes from the artery of the opposite side before it begins to flow from the veins. If the ovarian and uterine arteries

of one side or both uterine arteries be ligated, the circulation in the uterus is not interfered with. A special anastomosis of branches of the uterine arteries around the cervix has been termed the *circular artery* of the cervix; from it an *azygos vaginal artery* descends to the vaginal wall.

The Vaginal Arteries.—As a rule, these arise from the anterior divisions of the internal iliac. Sometimes they spring from the uterine or middle hemorrhoidal. They run downward and inward to the sides of the vagina, dividing into several branches. Those of one side anastomose freely with those of the other, and with an azygos artery which runs down the middle of the anterior vaginal wall from the circular artery of the cervix. Branches are given to the bladder and lower part of the rectum.



Fig. 64.—Dissection showing terminal portion of uterine artery of right side: 1, Uterine artery; 2, cervicovaginal artery; 3, azygos vaginae; 4, ovarian artery; 6, uterus; 8, broad ligament (Nagel).

Vesical Arteries.—Each superior vesical artery is, at its commencement, a portion of the hypogastric artery of the fetus which remains pervious after birth. It divides into several twigs which supply the upper part of the bladder, and give a branch to the urachus, as well as to the lower part of the ureter.

One or more of the hindmost branches of the superior vesical are sometimes described as *middle vesical*, being distributed to the part of the bladder related to the cervix and upper end of the vagina.

Each inferior vesical artery is derived from the anterior division of the internal iliac, and supplies the lower portion of the bladder, including the trigone. Anastomoses exist between the branches of the different vesical arteries.

The Middle Hemorrhoidal Arteries.—These vessels generally spring from the inferior vesical, sometimes from the internal pudic. They ramify on the lower part of the rectum, anastomosing with twigs from the other hemorrhoidal vessels and with the inferior vesical. The superior hemorrhoidal artery is the downward continuation of the inferior mesenteric.

The Internal Pudic Arteries.—Each of these forms one of the terminal branches of the anterior division of the internal iliac. From its origin in front of the pyriformis muscle it descends with the sciatic artery, leaves the pelvis by the lower part of the great sacrosciatic foramen, crosses the ischial spine,

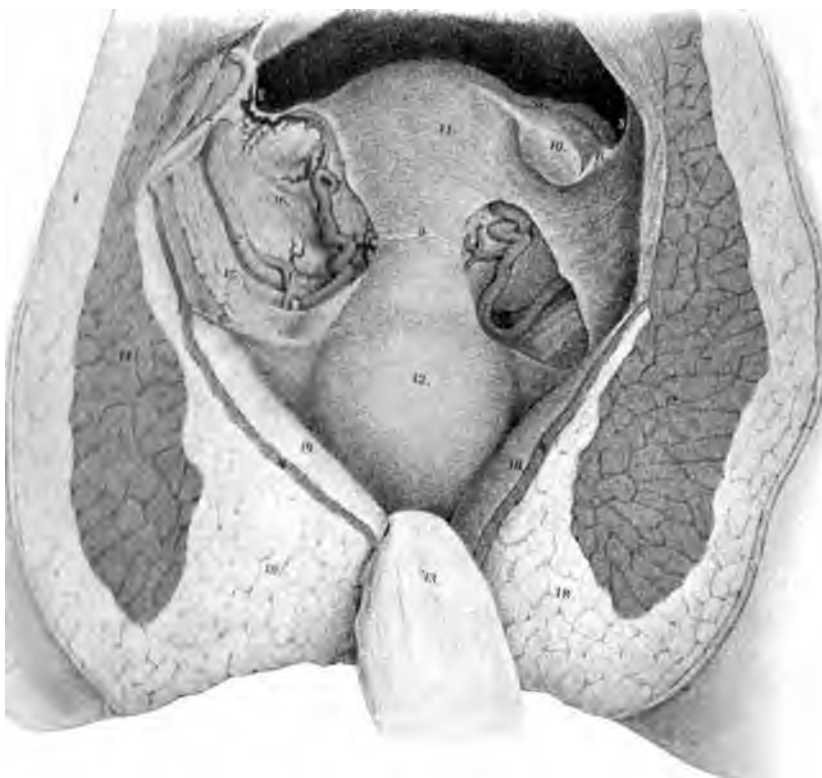


Fig. 65.—Dissection of pelvis from behind to show the ureter and uterine artery: 1, Uterine artery; 2, ureter; 3, Fallopian tube; 4, levator ani; 10, ovary; 12, vagina (Nagel).

and reënters the pelvis through the lesser sacrosciatic foramen. It then passes forward internal to the ischial tuberosity, and gradually crosses the side of the pubic arch until it lies external to the descending ramus of the pubes. After crossing the ischial spine it gives off the inferior or external hemorrhoidal artery, supplying the region of the anus; the superficial perineal artery, supplying the labia; the transverse perineal; the artery of the vestibular bulb; the deep artery of the clitoris going to its corpus cavernosum; the dorsal artery of

the clitoris going to the glans and prepuce. The inferior twigs of the external pudic branches of the femoral artery give some supply to the labia.

Deep Epigastric Artery.—This arises from the external iliac just above Poupart's ligament. It is at first directed inward for a short distance between that ligament and the internal inguinal ring, and then passes upward on the inner side of that opening between the peritoneum and the transversalis fascia. As it turns around the ring it is crossed on the outer side by the round ligament of the uterus. As it ascends it pierces the transversalis fascia and passes over the fold of Douglas, entering the sheath of the rectus, being close to the pos-

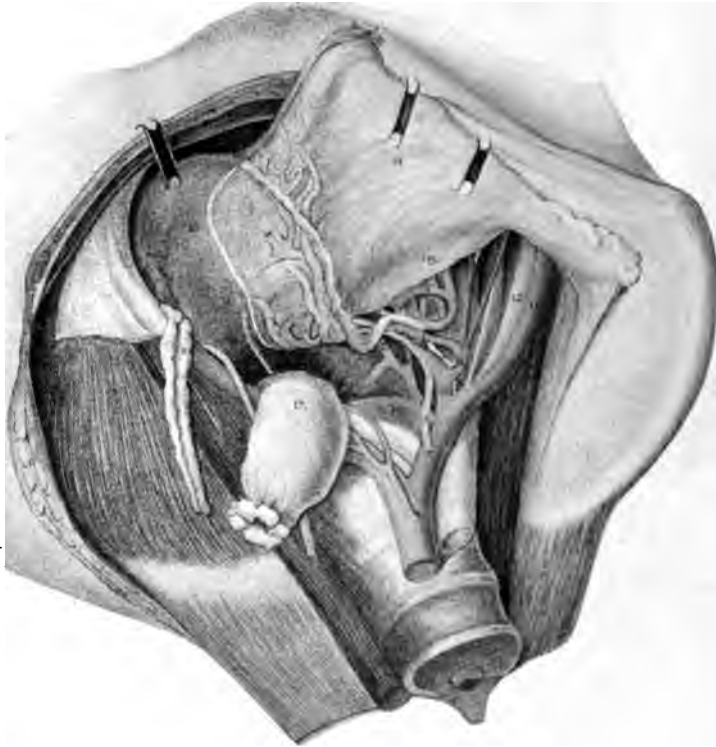


Fig. 66.—Dissection of pelvis from above: 1, Uterine artery; 2, ureter; 11, external iliac artery; 12, external iliac vein; 13, uterus; 14, anterior layer of broad ligament pulled forward; 15, bladder; 17, rectum (Nagel).

terior surface of that muscle. At or above the level of the navel it divides and anastomoses with descending branches of the internal mammary. Of the various branches of the artery, only one need be noted—viz., that which passes to the round ligament.

Superficial Epigastric Artery.—This arises from the femoral half an inch below Poupart's ligament. It passes through the fascia lata or saphenous opening and extends upward in the superficial fascia covering the abdominal external oblique muscle as high as the level of the umbilicus. It anastomoses with the deep epigastric branches.

VEINS.

The veins of the pelvis form an extensive network, and, as a rule, they possess no valves. To different parts of the network special names are given: the uterine plexus, surrounding the uterus; the ovarian or pampiniform plexus, in the broad ligament; the vaginal plexus, one outside the muscular coat, one

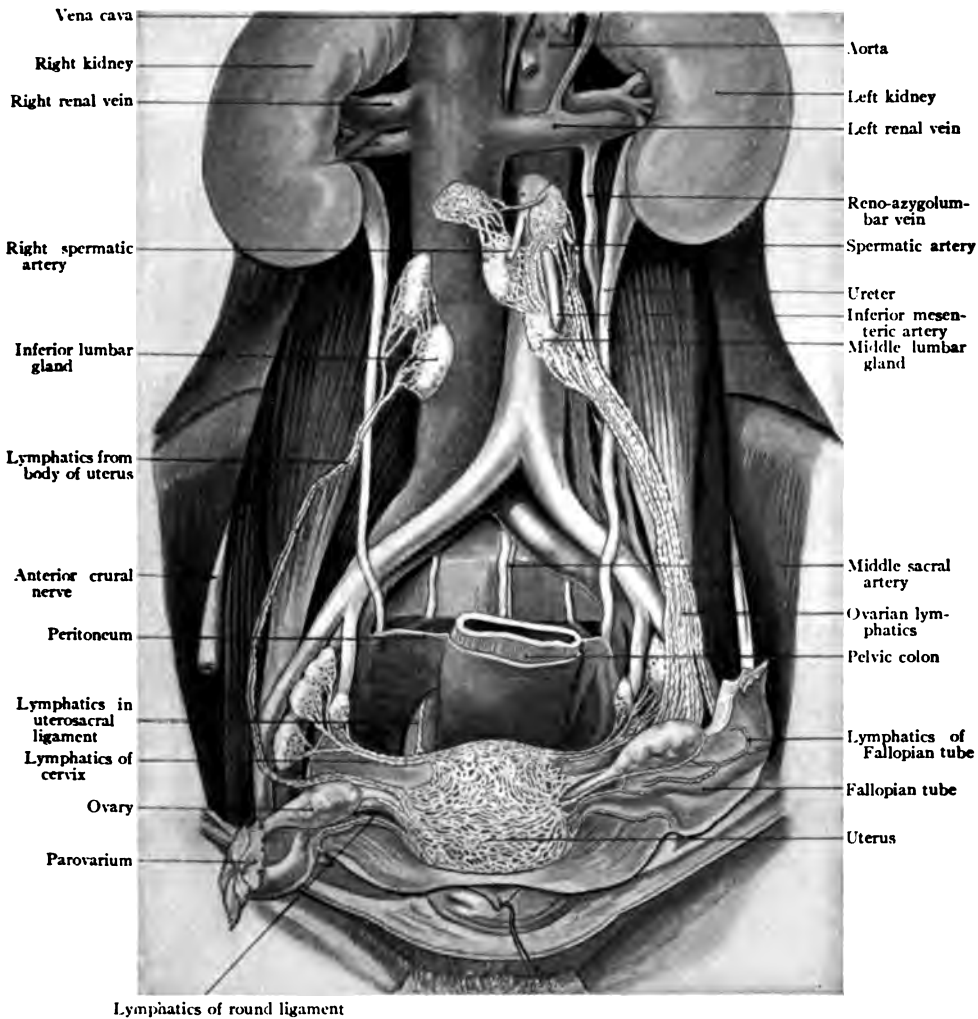


Fig. 67.—General view showing the lymphatics of the internal genital organs of the female (Poirier).

in the submucous tissue; the vesical plexus; the hemorrhoidal plexus, outside the mucosa of the lower part of the rectum. Communications occur more or less freely between these, and from them blood is carried away by veins corresponding to the arteries which have been described.

The hemorrhoidal plexus, situated in the lower part of the rectum under the mucosa, communicates freely with the plexuses in front of it. From it proceed the superior, middle, and inferior hemorrhoidal veins, corresponding to arteries of the same name. The superior hemorrhoidal vein enters the portal system. Consequently the hemorrhoidal plexus forms a communication between the portal and the general venous system.

At the upper end of each ovarian vein there is usually a valve. This is often absent in the left side, when in place of it there is one in the left renal vein near the junction. Most of the blood in the uterine plexus is drained by the ovarian veins.

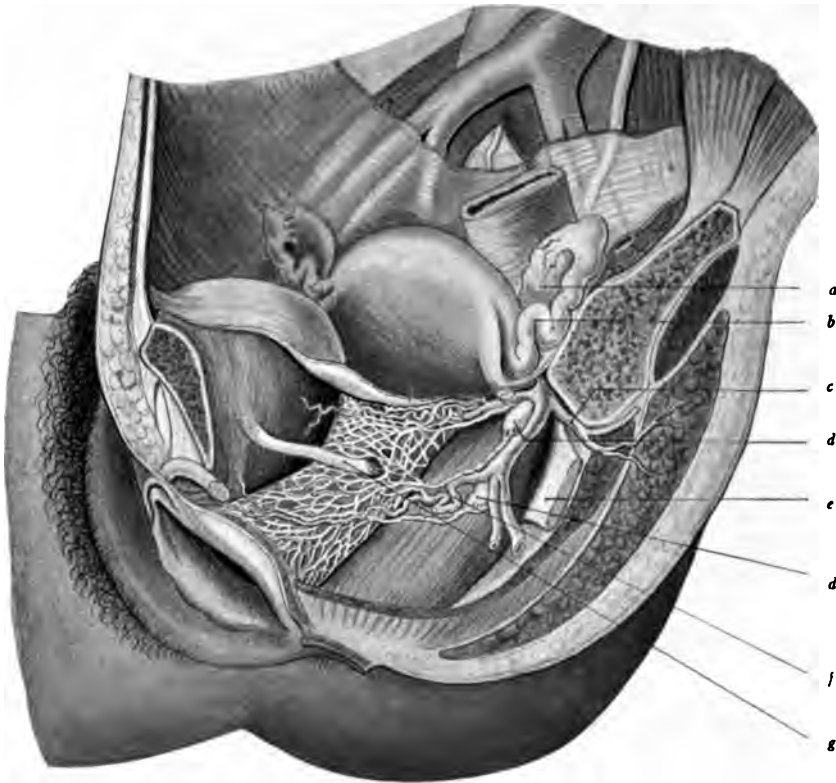


Fig. 68.—Lymphatic vessels of the middle third of the vagina and the glands in which they end: *a*, Ovary; *b*, Fallopian tube; *c*, lateral sacral artery; *d*, *d'*, vaginal gland; *e*, sciatic nerve; *f*, vaginal artery; *g*, ureter (Poirier).

The veins of the labia correspond to the arteries. Those of the labia minora communicate with the pars intermedia of the bulb. The veins of the clitoris communicate by means of the dorsal vein with a plexus around the upper part of the urethra, which joins the vesical plexus. The veins of the bulb join the vaginal plexus.

LYMPHATIC GLANDS AND VESSELS.

In studying the female pelvis special attention should be given to the following parts of the lymphatic system:

The lymphatics of the labia majora, labia minora, clitoris, vestibule, perineum, and lower fourth of the urethra and vagina communicate with the superior division of the external inguinal glands.

The lymphatics of the upper three-fourths of the vagina and urethra and of the cervix and bladder are stated by Sappey to open into the hypogastric or internal iliac glands. According to LeBec, the vaginal lymphatics form a series of trunks at the level of the uterine isthmus, and, being joined by those

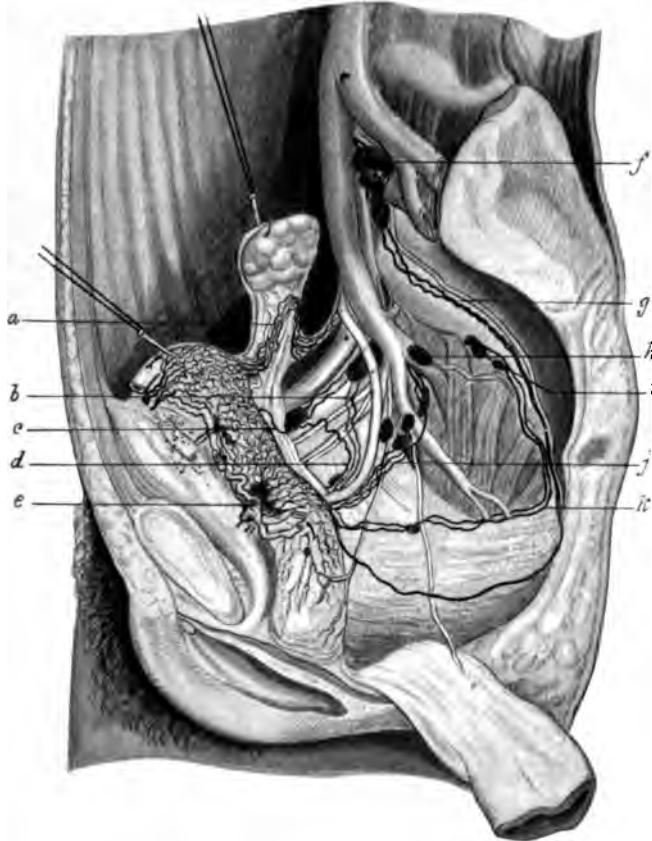


Fig. 69.—Lymphatics of the uterus: *a*, Lumbar pedicle of the body; *b* and *c*, external iliac pedicle of the neck; *d*, external iliac pedicle of the body; *e*, juxtacervical lymphatic knot; *f*, gland of the promontory; *g*, pedicle of the promontory of the neck; *h*, intrapelvic gluteal gland; *i*, lateral sacral glands; *j*, hypogastric pedicle of the neck; *k*, lateral sacral pedicle of the neck (Cunéo and Marcille).

of the cervix, pass to the obturator gland of Guérin, a small group of glands at the obturator foramen which communicate with the internal iliac glands.

The lymphatics of the uterine body are distributed as follows: Some pass to the upper group of hypogastric glands, others run with lymphatics from the ovarian region to the median group of lumbar glands situated in front of the aorta near the lower ends of the kidneys. Usually one or two small lym-

phatics pass along the round ligaments and communicate with the superficial inguinal glands.

The lymphatics of the rectum communicate with glands in the mesorectum or with the sacral glands.

The chief groups of glands are the following:

1. Superior division of the inguinal glands situated external to the deep fascia in line with Poupart's ligament. Besides receiving the lymphatics of the external genitals as described, they receive lymphatics of the round ligament and communicate

with the deep inguinal and with the external iliac glands.

2. Hypogastric or internal iliac glands, lying between the external and internal iliac vessels. They receive the lymphatics from parts of the vagina, uterus, and bladder as described, and also those from the obturator, sciatic, and other areas. Their efferent vessels join the lumbar glands.

3. Lumbar glands, arranged in a median and two lateral groups. The median group lie along the common iliac vessels, aorta, and vena cava; they receive efferent vessels from the external, internal iliac, and sacral glands, and lymphatics from the ovaries, tubes, upper part of the uterine body, kidneys, and suprarenal bodies. Each lateral group lies behind the psoas, receiving lymphatics from the posterior abdominal

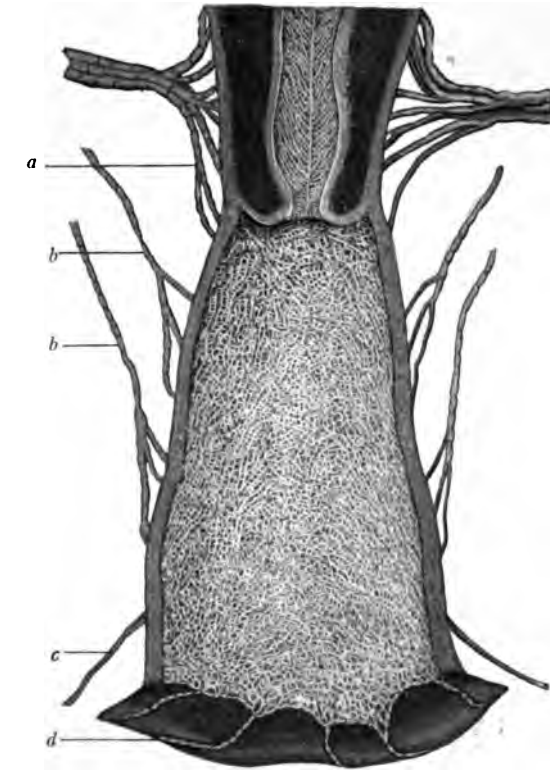


Fig. 70.—Lymphatic network of the mucous membrane of the vagina with their efferent trunks: *a*, Utero-vaginal lymphatics (superior group); *b*, *b*, vaginal lymphatics (middle group); *c*, vaginal lymphatics (inferior group); *d*, lymphatics of the vulva (Poirier).

wall. The efferent vessels of the lumbar group unite to form a lumbar lymphatic trunk which joins the thoracic duct.

4. External iliac glands, lying along the external iliac vessels. They receive efferent vessels from the inguinal glands and deep lymphatics from the abdominal wall. Their efferent vessels join the lumbar glands.

5. Guerin has described a gland or group of small glands within the pelvis in the region of the obturator foramen. They communicate with the internal iliac glands, and, it is stated, the inguinal group.

6. Sacral, lying on the anterior surface of the sacrum and in the mesorectum. They receive lymphatics from the rectum, bone, and other neighboring structures.

Championnière has described a gland as occurring close to the isthmus uteri. Bruhns and Sappey have noted one occasionally close to the cervix near the junction with the vagina. Bruhns in one instance found a small gland close to the uterine artery where it crosses the ureter.

NERVES OF THE PELVIC VISCERA.

The uterus is supplied both by the spinal and sympathetic nervous system, mainly from the latter. The sympathetic fibers are derived from the hypogastric plexus, which lies between the common iliac arteries. It is a continuation of the aortic and renal plexuses. From it is derived the inferior hypogastric plexus, one on each side of the rectum. These are joined by twigs, especially from the third and fourth sacral, and also by branches from the sacral sympathetic ganglia. From each of these pelvic plexuses smaller plexuses are distributed along the course of the vessels to the various viscera. The part which passes in toward the cervix joins the cervical ganglion situated on each side, close to the vaginal roof.

For a long time there was a dispute as to this ganglion, first described by Robert Lee, Sharpey being prominent in denying its existence. It is surrounded by a dense plexus (uterovaginal), and is connected with a vesical plexus, in which a ganglion is also situated.

The nerves of the uterus arise mainly out of these ganglion plexuses, especially from the cervical. Recently it has been suggested that the cervical ganglion plays an important rôle in connection with labor, pressure on it as the cervix expands leading to the continuance of the process. A few nerves go directly to the uterus from the hypogastric plexus and from the ovarian plexus. Herff and Gawronski have found ganglionic cells in the muscularis, and the latter has traced fibrils to the glandular and surface epithelium.

Herlizka has demonstrated medullated fibers in the wall with endings between the muscular bundles. They are derived from the cerebrospinal system, represented by the third and fourth sacral nerves.

The ovaries are supplied mainly by nonmedullated fibers derived from the sympathetic plexus surrounding the ovarian vessels. These come from the renal and aortic sympathetic plexus; in the latter on each side near the lower end of the aorta an ovarian (spermatic) ganglion has been described. Branches of the uterine plexus also extend to the ovary along the branch of the uterine artery, which anastomoses with the ovarian artery. (A ganglion has been described near the uterus.) The nerves seem to end largely in the vessel-walls, but special plexuses are found surrounding the Graafian follicles, from which delicate fibrils penetrate as far as the membrana granulosa.

E. Winterhalter describes a special collection of ganglionic cells in the medullary portion of the ovary and thinks they may regulate menstruation.

The Fallopian tubes are supplied both from the ovarian and the uterine plexuses.

The vagina derives its nerves from the inferior hypogastric plexus, communicating with the cervical ganglion and vesical ganglion plexuses.

Branches of the third and fourth sacral nerves and pudic nerves supply the medullated fibers which are found. There is a dense network of nerves in the muscularis and in the submucosa. Gawronsky has traced the nerve terminations in the epithelial cells. Special end-organs are also found.

The external genitals are supplied by sympathetic nerves running with the arteries, and by twigs of the genitocrural branch of the lumbar plexus, as well as by those from the inferior pudendal and internal pudic branches of the sacral plexus. The clitoris is supplied by twigs from the latter nerve. The erectile tissue is supplied by the sympathetic fibers.

The bladder is supplied on each side from two sources: (a) from the spinal system, fibers being derived from the third, fourth, and, sometimes, second sacral nerves, termed the pelvic splanchnics (Gaskell). They pass directly to the pelvic plexus without going through the ganglionic cord of the sympathetic. (b) From the hypogastric plexus, the fibers being mostly nonmedullated.

Von Zeissl states that the pelvic splanchnics supply only the longitudinal muscle-fibers of the bladder. Griffiths, however, states that stimulation of the peripheral cut ends causes contraction of the entire muscular wall on the same side. These nerves are also sensory for the bladder. If the peripheral divided ends of the hypogastric fibers be stimulated, there is only feeble contraction of the corresponding half of the bladder (Langley); if the viscus be contracted, stimulation causes rapid relaxation (Griffiths). Some sensory fibers are also derived from the hypogastric fibers.

The urethra is supplied from the same sources as the vagina. The nerves also communicate with the vesical plexus. The ureters are supplied from the inferior mesenteric, ovarian, and hypogastric plexuses. Fine plexuses are formed in the outer and muscular coats, containing a few ganglion-cells.

THE PELVIC FLOOR.

I shall consider this subject under the following heads:

1. The meaning of the term "pelvic floor."
2. The floor studied by dissection.
3. The floor studied by frozen sections.
4. The physics of the pelvic floor.

1. THE MEANING OF THE TERM "PELVIC FLOOR."

The term "floor" is not a good one, since it leads one to think of the floor of a house, *e. g.*, a rigid partition running transversely between walls. Consequently, in looking for a floor in the pelvis, we are apt to seek for something which has the character of a house floor. The pelvic floor has no structure. It is not a rigid partition, nor does it run transversely. It is elastic and movable, varying in its thickness, its nature, and its slope at various parts, while it runs across a very irregularly shaped space—the outlet of the bony pelvis. It is composed of a variety of tissues, differing in their consistence, their strength, and the firmness of their attachment to the bony wall. The chief purpose of the pelvic floor, as a floor, is undoubtedly to sustain the weight of the great mass of abdominal viscera, or, in other words, to resist the intra-abdominal pressure. An increase in the intra-abdominal pressure, a weakening of the

floor, or both these conditions combined, may lead to a hernial protrusion of the floor, just as corresponding conditions in the abdominal wall produce a similar result.

In strict anatomic accuracy, therefore, it must be admitted that all those structures in connection with the pelvic outlet which help to resist and support this pressure, and whose removal would be a source of weakness, must be considered as forming a part of the floor.

According to Hart, the floor is composed of those tissues which close the outlet of the pelvis, being bounded by skin externally and by peritoneum internally, the uterus and appendages being removed. He divides it into an anterior part, called the pubic segment, and a posterior part, called the sacral segment, the line of division between the two being the vaginal slit. Studied in vertical mesial section, the former is seen to be triangular in shape, loose in texture, loosely attached to the pelvis, and to include the structures lying between the symphysis and the vaginal slit, being chiefly composed of bladder,

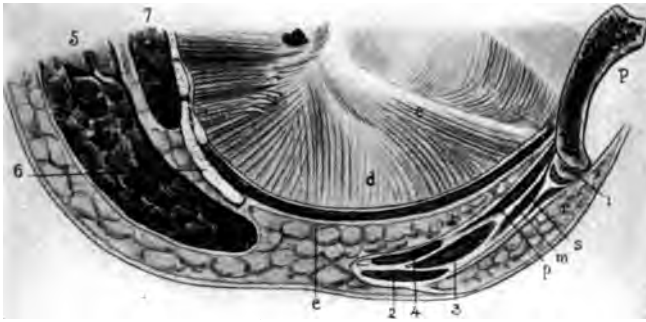


Fig. 71.—Sagittal lateral section, to the left of the pubic symphysis: P, Body of pubes; c, line of junction between pelvic fascia and obturator fascia; d, rectovesical fascia and obturator coccygeus muscle; e, inferior fascia of latter; s, lower layer of superficial perineal fascia; 1, sheath of deep layer of superficial fascia for the crus clitoridis; 2, superficial transverse perineal muscle; 3, bulb of vagina; 5, gluteus maximus muscle; 6, ischio-sciatic ligaments; 7, pyriformis muscle (Savage).

urethral, and anterior vaginal walls; the latter, strong in structure, embraces the tissue between the vaginal slit and posterior bony wall, firmly dovetailed into the sides of the latter. Symington, on the other hand, considers that "the rectum and the bladder, like the uterus, should not be regarded as parts of the pelvic floor, but as organs resting upon it." He further says that "the anterior part of the pelvic floor is composed of firm tissue, and is connected as strongly with the anterior part of the pelvic wall as is the sacral segment with the sacrum and coccyx." He also says that "only the lower half of the vagina is in the pelvic floor." Both of these authors have formed these different conclusions from their study of the pelvis by frozen sections.

While sectional anatomy is of the greatest value in demonstrating topographic relations of the component parts of the floor, there can be no doubt that by dissectional work alone can the structural arrangements be analyzed and the importance of the constituent elements determined.

2. THE FLOOR STUDIED BY DISSECTION.

Dissection is of prime importance, and should precede all other methods of studying the floor, for by it alone can we gain a true knowledge of the nature of the floor and of the complex arrangement of the structures composing it. I shall describe these structures singly, and discuss the value of each in regard to the support and strength given by it to the floor.

I. Pelvic Fascia.—This structure is, undoubtedly, of the very greatest value in resisting the intra-abdominal pressure at the pelvic outlet.

1. PARIETAL LAYER.—In front this layer, a strong aponeurotic membrane, for the most part, is continued across the subpubic arch as the so-called “posterior layer of the triangular ligament.” Its lower border blends with the base of

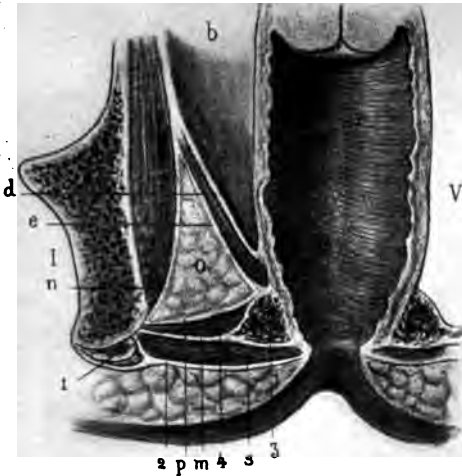


Fig. 72.—Coronal section of pelvis through middle of vagina: V, Vagina; O, ischio-rectal fossa; I, ischial tuberosity; d, rectovesical layer of pelvic fascia; e, anal fascia; n, obturator fascia; p, posterior layer of triangular ligament; m, anterior layer; s, deep layer of superficial perineal fascia; 1, crus clitoridis; 3, bulb of vagina (Savage).

the so-called “anterior layer of the triangular ligament” (triangular ligament proper), which is attached at its apex to the subpubic ligament, by its base to the superficial fascia and central point of the perineum, and by its sides to the pubic arch. It is perforated by the urethra and vagina, and is thereby considerably weakened. This layer is never recognized as a distinct membrane in frozen sections because it is blended with adjacent structures; it certainly forms part of the pelvic floor, strengthening its anterior part, helping to support and steady the urethra and vagina as well as the perineum. In the posterior part of the pelvis the parietal layer plays a less important part in helping to bridge across the greater and lesser sacrosciatic notches. Here the

great and small sacrosciatic ligaments are the most important supports, though the parietal fascia internal to them and attached to them is an additional source of strength. (I do not think that the importance of the sacrosciatic ligaments in regard to the mechanism of labor has been sufficiently noticed. From their position and strength they must influence considerably the course of the various parts of the fetus as they appear successively at the pelvic floor in labor. As the coccyx is driven downward and backward they must also be considerably stretched.)

Laterally, the fascia covers the obturator internus and pyriformis muscles. The portions related to these structures are respectively termed *obturator fascia*, *fascia of the pyriformis*.

2. VISCERAL LAYER.—This layer and its divisions are scarcely noticed by

most writers in gynecology. The pelvic fascia is generally studied in the dissecting-room in the male; its arrangement in the female is not usually dwelt on to any considerable extent.

There can be no doubt that it forms an important resisting structure to the intra-abdominal pressure.

What is its disposition? In the greater part of its extent it springs from the parietal layer along the *white line*. This *white line* passes around the pelvic wall from the ischial spine behind to a point on the posterior surface of the symphysis pubis, a little above its lower end. The visceral layer passes inward, on each side, upon the upper surface of the levator ani to the lateral walls of the bladder, vagina, and rectum, where it divides into four layers:

(a) *Vesical Layer*.—This layer turns upward upon the lower lateral aspect of the bladder, forming the "*lateral true ligament of the bladder*." It is in firm union with the bladder-wall, and thins as it passes upward over the viscus to be continuous with the corresponding layer of the opposite side.

(b) *Vesciovaginal Layer*.—This layer, thin but strong, passes between the bladder and the anterior vaginal wall, being in firm union with both, and being continuous with the corresponding layer of the opposite side. At its posterior part it blends with the connective tissue which attaches the posterior wall of the bladder to the neck of the uterus.

(c) *Rectovaginal Layer*.—This layer passes between the vagina and the anterior wall of the lower part of the rectum. Except for a short distance behind the upper part of the vagina, the union between this layer and the vaginal and rectal walls is very firm. Below it is continuous with the strong connective-tissue elements of the perineal body. It is continuous with the corresponding layer of the opposite side.

(d) *Rectal Layer*.—This layer passes behind the rectum, attached to its walls, and joins the corresponding layer of the opposite side. It is prolonged

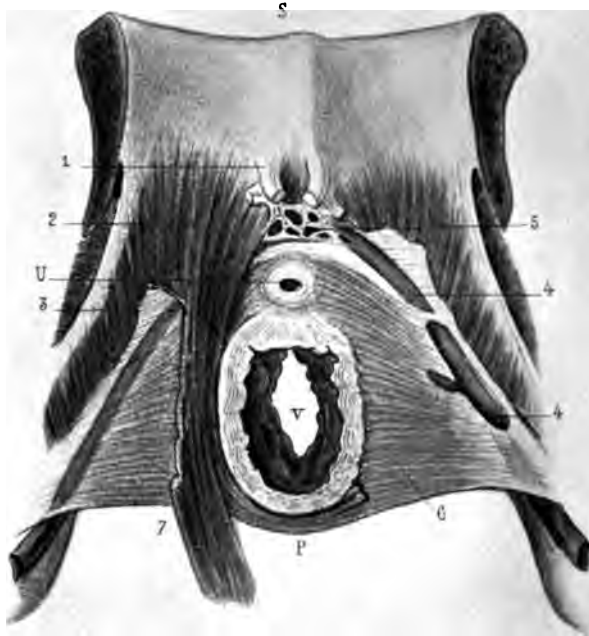


Fig. 73.—Dissection showing structures behind and below pubic arch: S, pubic symphysis; U, urethra; V, vagina; 1, anterior true ligament of bladder; 2, pubococcygeus muscle; 3, obturator coccygeus muscle; 5, urethropubic venous plexus; P, perineum; 7, median portion of pubococcygeus muscle (Savage).

downward as a thin layer toward the lowest part of the gut, being, of course, internal to the levator ani.

These layers in sections are not always made out with ease as distinct fascial structures, on account of their intimate blending with surrounding parts. They are more readily made out by dissection when traced from their parietal origin inward in the uncut pelvis.

They are of great significance, and are undoubtedly of chief importance *in slinging the bladder, the vagina, and the lower part of the rectum in the pelvis*. In most obstetric and gynecologic works I find no mention of them whatever.

(e) *Anterior Visceral Layer*.—Further, the arrangement of the visceral fascia in the anterior part of the pelvis is of considerable importance. Here

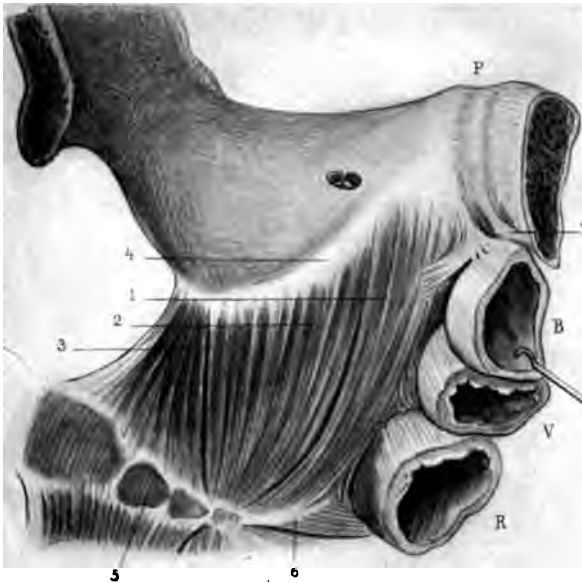


Fig. 74.—Relation of muscular floor of pelvis to bladder, vagina, rectum, and coccyx: 1, Pubococcygeus muscle; 2, obturator coccygeus muscle; 3, ischiococcygeus muscle; B, bladder; V, vagina; R, rectum (Savage).

the visceral layer, arising from the back of the lower part of the pubes on each side of the middle line, above the point of origin of the anterior fibers of the levatores ani, as well as the attachment of the parietal fascia, passes backward as two strong bands above them and on each side of the urethra to become blended with the anterior surface of the bladder. These are the *anterior true ligaments of the bladder*. Between them is a space filled with loose connective tissue and fat, continuous below with the retropubic fat and above with the suprapubic or retroperitoneal fat.

(f) *Anal Fascia*.—Lastly, there is a thin, aponeurotic membrane, which arises from the parietal fascia along the white line under the attachment of the levator ani, and passes downward, closely attached to the muscle, and blending with the corresponding layer of the other side and with the other connective-tissue elements of the perineum. In front it is attached to the posterior layer of the triangular ligament (parietal pelvic fascia). This layer is called by some the *anal fascia*, and by others the *aponeurosis of the levator ani*.

II. Superficial Fascia.—Under the skin, over all the lowermost part of the pelvic floor, is a well-marked layer of superficial fascia. Toward the skin it consists of fine fibrous trabeculae containing a large quantity of fat, which

is most abundant behind and on each side of the anus; over the tuberosities of the ischium this superficial fascia becomes tough and stringy, the fibrous septa being thicker and stronger, attaching the skin to the bone. *The deep layer* is of more importance, being dense and aponeurotic, and giving considerable strength to the pelvic floor through its attachments. *Anteriorly* it is attached to the lower edge of the pubic and ischial rami, extending back almost to the tuberosities; *posteriorly* it blends in the perineum with the base of the triangular ligament.

III. Pelvic Muscles Entering into the Floor.—*Levatores Ani.*—

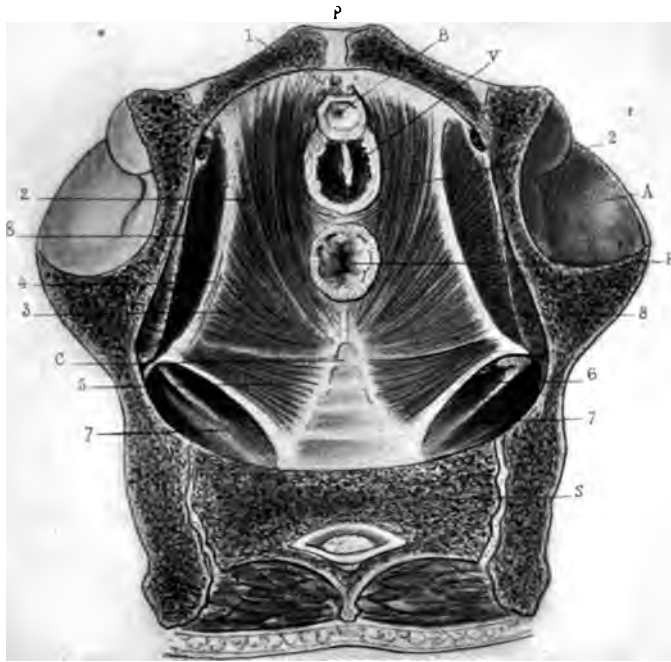


Fig. 75.—Muscular floor of pelvis denuded of fasciæ: B, Neck of bladder; V, vagina; R, rectum; C, coccyx; 1, anterior true ligament of bladder; 2, pubococcygeus muscle; 3, obturator coccygeus muscle; iliopubic line of origin of latter; 5, ischiococcygeus muscle; 7, pyriformis; 8, obturator muscle (Savage).

These muscles together form a muscular diaphragm with the concavity upward. They are usually described as being of chief value in strengthening the pelvic floor. That they are the most important muscles in the floor is true; but on account of their thinness it seems to me that they cannot *per se* exercise a very great influence in resisting the intra-abdominal pressure. Savage divides each into two portions, namely, the *pubococcygeus* and the *obturator coccygeus*. Symington has well described the arrangement and functions of these.

The *pubococcygeus* passing on each side, from the back of the pubes to the last two pieces of the coccyx, acts as a sphincter of the lower part of the vagina

and the anal canal, and tend to draw upward and forward the perineal body and coccyx. A few fibers blend with the urethral and vaginal walls, others turn inward in the perineal body in front of the *internal sphincter* of the anus; behind the anus there is a blending of some fibers of both sides in the ano-coccygeal ligament.

The *obturator coccygeus*, the main part of the muscle, arises from the white line between the pubes and the ischial spine. It runs backward, downward, and inward to the sides of the coccyx. With these should be associated the thin *coccygei muscles*, which arise from the ischial spines and small sacro-

sciatic ligaments, and are inserted into the sides of the last sacral and the coccygeal vertebræ. They have no direct action upon the pelvic viscera. They help to fill in the sides and posterior part of the pelvic outlet; they resist somewhat the intra-abdominal pressure, and they can elevate the coccyx after it has been bent downward.

This is quite different from the ordinary impression which the student has regarding the arrangement of these muscles. It is usually understood that the great mass of the *levator ani* arising from the white line passes downward and inward and, while being attached behind to the coccyx, mainly converges toward the middle line, where it



Fig. 76.—Superficial fascia of perineum: A, Anus; V, vagina; M, urethra; C, clitoris; T, ischial tuberosity; c, obturator coccygeus muscle; a, gluteus maximus muscle; s, deep layer of superficial fascia; K, ischiopubic ramus (Savage).

blends with the muscle of the opposite side in the perineal body and behind the anus. Coronal sections are largely to blame for giving this false impression. The truth is that the main part of the muscle arising from the white line passes backward to be attached to the coccyx and lower part of the sacrum, and meets the corresponding portion of the opposite side in the middle line, only at the tip of the coccyx. It is the anterior and smaller portion, the so-called *pubococcygeus*, which alone, by means of its attachment to the urethral and vaginal walls and by its blending with the cor-

responding muscles of the opposite side in the perineum and behind the anus, helps to strengthen the pelvic outlet across the middle line. Its outer fibers are, of course, parallel to and continuous with the *obturator coccygeus*, and hence the utterly erroneous impression which the coronal sections give of the *levator ani* arising from the white line and being inserted into the perineum. The value of the *levator ani* to the pelvic floor has, indeed, no doubt, been greatly overstated. Kelly goes so far as to describe the muscular part of the floor as its principal strength. If one imagines the visceral portions of the pelvic



Fig. 77.—Deep fasciæ of the perineum: a, Gluteus maximus muscle; L, great sacrospinous ligament; T, tuber ischii; c, pubococcygeus and obturator coccygeus muscle; A, anus; b, sphincter ani externus; d, e, superficial transverse and bulbocavernosus muscles; g, lower portion of erector clitoridis muscle; C, clitoris; V, vagina; l, bulb (Savage).

fascia and the anal fascia removed, it is not difficult to realize the comparative weakness of the muscular diaphragm in supporting the intra-abdominal pressure.

The other muscles of the pelvic floor play a minor part in strengthening it. The *transversus perinei* is a very small muscle, very difficult to define, and less developed in the female than in the male.

It arises on each side from the inner aspect of the ischial tuberosity above the origin of the ischiocavernosus, and passes to the central point of the perineum.

The *ischiocavernosus* (*erector clitoridis*) embracing each crus clitoridis arises from the inner surface of the ischial tuberosity and ramus and is inserted into a fascia which envelopes the posterior part of the body of the clitoris.

The *sphincter vaginae* (*bulbocavernosus*) is a thin, subcutaneous band of muscle, $\frac{1}{4}$ inch broad, attached behind to the central point of the perineum. It surrounds the vestibule and vaginal orifice, closely embracing the two vestibular bulbs on their outer side. In front it is attached mainly to the corpora cavernosa of the clitoris. Some of the fibers pass transversely in front of the urethral orifice. It helps, in a very small degree, to strengthen the

floor through its sphincter action on the vagina (though, according to Symington, this is very slight, its main action being merely to compress the vestibular bulbs) as well as through its attachment to the clitoris in front and to the central point of the perineum behind.

The *sphincter ani* in the same way helps by its sphincter action on the anus as well as through its attachment to the central point of the perineum in front and the tip of the coccyx behind.

The *transversus perinei profundus* (*compressor or constrictor urethrae*), arising from the inner aspect of the junction of the rami of the pubes and ischium, passes in front of the

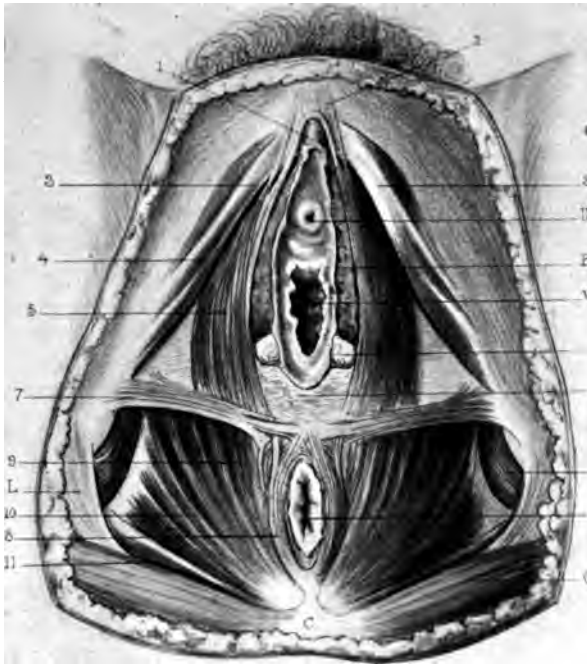


Fig. 78.—Muscles of perineum: p, Perineum; A, anus; V, vagina; 1, clitoris; 2, its suspensory ligament; 3, crus clitoridis; 4, erector clitoridis muscle; 5, bulbocavernosus muscle; 7, superficial transverse perineal muscle; 8, sphincter ani externus; 9, pubococcygeus muscle; 10, obturator coccygeus muscle; 11, ischiococcygeus muscle; 12, obturator externus muscle (Savage).

urethra and behind the vagina, being also attached to their walls, and blends with the corresponding muscle of the opposite side.

This muscle in the male is not divided (as it is in the female, by the vagina), and exercises an important part in diminishing the caliber of the urethra at the end of micturition.

These various muscles are very small, and while undoubtedly helping to consolidate and strengthen the floor, play but a minor part in this capacity.

Gluteus Maximus.—The lower part of this muscle as it passes downward and forward from the side of the coccyx over the ischial tuberosity is a source of strength to the pelvic floor in its posterior and outer part.

IV. Viscera and Passages Connected with Pelvic Floor.—Certain viscera are connected with the floor; certain passages pierce it. Are they to be described as forming part of the floor? Hart describes the bladder and urethra, the vagina and the rectum, as forming part of the floor, the uterus and appendages resting upon it. Symington differs from Hart in saying that the upper part of the bladder, the upper part of the vagina, and the rectum are not a portion of the floor. Ranney and Foster differ from Hart in including the uterus.

In order to ascertain the truth it is necessary to make a detailed study of the viscera and their relationships.

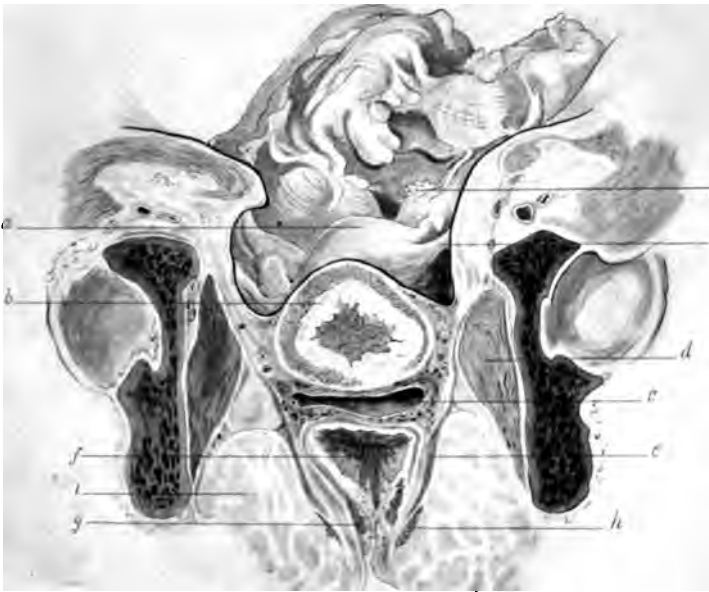


Fig. 70.—Coronal section of pelvis of a multipara: *a*, Uterus; *b*, bladder; *c*, vagina; *d*, obturator internus; *e*, levator ani; *f*, rectum; *g*, internal sphincter; *h*, external sphincter; *i*, ischiorectal fossa; *j*, left tube; *k*, left round ligament (Sellheim).

BLADDER.—This organ, independent of its being empty or filled, has a very intimate connection with the anterior part of the floor. *Per se* it does not resist the intra-abdominal pressure; *through its connections* and those of the urethra, by which it is slung in the pelvis, it does perform this function to a very considerable extent.

These connections are as follows:

Fascial.—Anterior and lateral *true* ligaments; vesicovaginal layer of the visceral pelvic fascia; triangular ligament.

Muscular.—Pubococcygeus division of levator ani; transversus perinei profundus.

Ordinary Connective Tissue.—That connecting it with the bony wall and the structures in immediate relation to the bladder and urethra.

Peritoneal.—False ligaments (unimportant).

Other Structures.—Urachus; obliterated hypogastric arteries; ureters.

Of all these, its connections with the pelvic wall through the visceral layers of the pelvic fascia are the most important.

Symington and Croom urge that the bladder should be regarded as resting upon the pelvic floor. The anatomy of the parts shows that it is embedded in the floor. Further, they say that because the organ fills and empties it cannot be considered as part of the floor. Is not this objection of the nature of a quibble? Are the anatomic connections not the same in all conditions of the bladder? If between two posts we tie a rope, forming a kind of suspension bridge, and then, cutting the rope in two, attach between the ends a strong bag which can be filled and emptied, is the bag, because it is hollow, and capable of being filled and emptied, not to be considered as forming part of the bridge? The analogy is a fair one. The bladder is simply a bag slung between the walls of the anterior and lower part of the pelvis.

VAGINA.—The wall of this passage is slung in the pelvis by fascial and muscular attachments, and is thereby made to form an intimate portion of the pelvic floor.

These attachments are as follows:

Fascial.—Triangular ligament and anterior layer of the parietal pelvic fascia, which it pierces; vesicovaginal layer of visceral pelvic fascia; vaginorectal layer.

Muscular.—Pubococcygeus division of levator ani; sphincter vaginæ; transversus perinei profundus.

Ordinary Connective Tissue.—That connecting it with the bony wall.

Secondary.—Through its very firm junction with the urethra, the base of the bladder, and the lower part of the rectum, it is supported by the attachments of these structures.

The analogy made in reference to the bladder will apply here again. Symington is unwarranted in including in the pelvic floor the main extent of the vagina, but excluding a small portion of the upper end, because the latter is less firmly united to neighboring structures than the lower. These connections are of small importance, *in re* the part they play in giving support. It is the lateral attachments of the vagina to the pelvic wall, by means of the fascial layers of the floor, which are of chief importance. I quite admit, however, that the vesicovaginal and rectovaginal layers are thinner and weaker in their upper part than elsewhere.

RECTUM.—Most of the authors already quoted are not precise in their reference to this structure. All are agreed that the lower portion of the wall of the gut forming the anus is an intimate part of the floor. It is disputed as to where the upper limit ends. The so-called *first part* of the rectum—that part provided with a mesentery, must be excluded. The *second part*, which extends from the first part to the tip of the coccyx and resting against the sacrum, coccyx, obturator coccygeus part of the levator ani, and the coccygeus itself, to all of which it is attached, cannot be considered as forming a part of the pelvic floor, since the intra-abdominal pressure tends to push it, not out of the pelvis, but against the posterior wall.

From the coccyx downward the wall is a part of the pelvic floor, its attachments being as follows:

Fascial.—Rectovaginal layer of visceral pelvic fascia; rectal layer of visceral pelvic fascia.

Muscular.—Pubococcygeus portion of levator ani; sphincter ani.

Connective Tissue.—That connecting it with surrounding parts and with the bony wall.

Secondary.—Through its attachments to the posterior vaginal wall and perineum.

The lowest part of the rectum, therefore, is, like the vagina, a tube slung

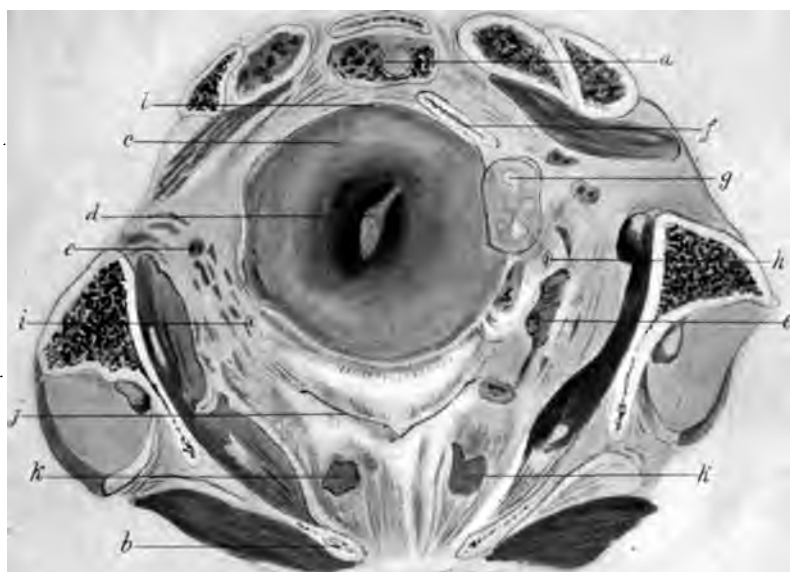


Fig. 80.—Transverse section of pelvis of a woman who died fifteen days after labor. The face of the lower part of the pelvis is shown: *a*, Junction of second and third sacral vertebræ; *b*, descending rami of pubes just below the symphysis; *c*, uterus; *d*, uterine cavity; *e*, parametric tissue with many blood-vessels; *f*, rectum; *g*, prolapsed left ovary; *h*, left ureter; *i*, right ureter; *j*, bladder; *k*, opening in anterior wall of vagina; *l*, peritoneum.

between the sides of the pelvis by the fascial tissues of the floor, supported by certain muscles as well as by the vaginal and perineal attachments.

It must be borne in mind that the gut is quite closed unless distended by flatus or feces.

UTERUS.—Has this organ no claim to be considered part of the pelvic floor? According to Hart, it has not. He says that it merely *rests* on the floor, and is not *suspended*. This statement is opposed to the teaching of anatomists.

In order to determine this question, a developmental study of the uterus and its connections is necessary.

IN THE FÆTUS.—The common origin of the uterus and vagina from the fusion of the lower parts of the Müllerian ducts must be remembered. In the third and fourth months there is no distinction between the uterus and vagina. After this the uterine wall gradually becomes thicker, especially in the cervical portion, while a vaginal portion at the same time develops. The important fact to be noted, however, is that while the uterus is, in the fetus, relatively higher than in the adult condition, in other respects it has relations the reverse of those existing in the latter.

Thus, in the fetus, the cervix is both very much longer, as well as wider, than the body—exactly the reverse of the adult condition. In the fetus the thickness of the cervix in proportion to the pelvic diameter is relatively greater than in the adult condition. In the fetus there is relatively much less of the uterus covered with peritoneum than in the adult. The broad ligaments are, therefore, in the former relatively very small.

The cervix, which forms three-fourths of the whole uterus, is, save on its posterior surface, where it is covered with peritoneum, firmly embedded in the fascial and connective-tissue structures, below the peritoneum. In front it is attached to the bladder, which extends across the pelvis from side to side, the vesicovaginal layer of pelvic fascia passing between them and being connected with both; laterally it is connected with the pelvic wall. From its large size, relative to the width of the pelvic cavity, it is relatively nearer the wall than in the adult condition. In several of my specimens, from being somewhat nearer one side than the other, the attachment is very short, and the cervix is practically fixed in position.

In the fetus and new-born child it is evident, therefore, that the pelvic floor is relatively thicker, and occupies more of the pelvis than in the adult. The greater portion of the uterus—the cervix—is also, in the early period of life, an intimate part of the floor.

IN THE ADULT.—The change from the fetal to the adult condition is characterized by a marked increase in the length and width of the body in relation to the cervix of the uterus. The greater part of the organ is now covered with peritoneum, the broad ligaments being in relation to much more of the uterus than in early life. Owing also to the great growth of the pelvis, the cervix relative to the pelvic cavity is very much smaller than in the fetus, and is relatively, therefore, at a farther distance from its walls.

What, now, are the adult attachments of the uterus?

Fascial.—Posterior part of vesicovaginal layer of visceral pelvic fascia.

Connective Tissue.—That attaching cervix to bladder; that attaching cervix to side walls of pelvis (parametric); that attaching body to pelvis in the folds of the broad, uterosacral, and round ligaments.

Muscular.—Nonstriped muscle in the broad, round, uterosacral, and uterovesical ligaments.

Secondary.—Through its connection with the bladder and the vagina, which are, as already seen, slung in the pelvis.

What importance is to be attached to these various connections?

The vesicovaginal layer of pelvic fascia has not directly much influence in supporting the uterus, since it is very thin at its posterior limit, blending with the tissue joining the bladder and cervix.

The tissue between the bladder and cervix, though described being as

loose in nature, is yet sufficient to unite them intimately. It is, indeed, partly through this junction that the pubic segment is elevated during labor by the upward tension of uterine retraction, though, of course, the tension tells mainly on the vaginal wall, with which the uterine muscle is directly continuous.

Schultze points out that this connection is very rarely disturbed. He says that, "not only does the uterus closely follow the posterior wall of the bladder in the movements due to the variations in the quantity of the urine contained in it, but the bladder also follows the anterior wall of the uterus so closely, when the latter organ is displaced or enlarged, that the relation of the posterior bladder-wall to any tumor in or above the pelvis is of great diagnostic importance whenever there is any doubt as to the share the uterus has in the formation of the tumor."

The connective tissue between the cervix and pelvic wall on each side is loose in character. Nonstriped muscle is found in it.

What, now, is to be said regarding the broad ligaments? The peritoneal covering is of very little importance in giving strength. Within this covering, however, are fibromuscular and elastic tissues, which can be traced as bands in several places running from the uterus to the pelvic wall. The upper part of each ligament, which is freely movable, containing the tube and ovary, can have nothing to do with supporting the uterus. The lower portion is much thicker and stronger. This has been termed the *cardinal* ligament of the uterus by Kochs, and the *transverse ligament* of the cervix by Mackenrodt. If one exercise the slightest downward pressure on the uterus in the cadaver, it is found that a line of resistance is formed in the broad ligament running from near the cervix upward and outward toward its upper parietal attachment. The same thing is found during pregnancy and the puerperium. In pregnancy the suspending action of the ligaments is very evident.

In the nonpregnant woman, in normal conditions, this may scarcely at all be present, and it may serve merely to steady the uterus, but if the other supports of the latter be removed, or intra-abdominal pressure be increased, then the ligaments are stretched and endeavor to support the organ.

In the operation of vaginal extirpation of the uterus, after the latter has been divided from its vesical and vaginal connections, although the vagina be distended as widely as possible, the uterus does not tend to fall down, but is kept in position by its ligamentous attachments.

If at this stage the uterus be pulled down to the vulva and then let go, it is instantly drawn up again. Indeed, the difficult part of the operation is the ligating of these structures and the removal of the uterus from them.

The uterosacral and the uterovesical act in much the same manner as the broad ligaments, *i. e.*, they are in a condition of somewhat *elastic tension*. In a nullipara the cervix may be pulled a considerable distance down the vagina by means of a volsella, the uterosacral ligaments being put on the stretch. In a multipara they are more easily elongated.

It is the elastic nature of the broad and uterosacral ligaments that allows the uterus to be drawn down, and which helps partly to draw it up again. As already mentioned, this may take place even when the vaginal and bladder attachments are gone.

Inflammation in the ligaments renders them less elastic, and makes it difficult or impossible to draw down the uterus.

Where the tonicity has disappeared and they have become stretched and thinned, it is always a very easy matter to pull down the uterus. Luschka has considered the uterosacral ligaments of such importance that he has given the name of *muscularis retractor uteri* to the muscular tissue within them, and he says that they "determine and secure the normal position of the lower end of the uterus." It is objected by some that such thin folds cannot have much strength. The observations of Küstner on this point are worthy of special note. He has made a special microscopic study of the uterosacral folds, and says that while in the free portion of each there is very little muscle, at its lateral attachment there is a dense, flat, muscular bundle. He considers this almost equal in strength to the round ligaments.

Coe says that they commonly relax under the influence of an anesthetic. It is to be noted also that the uterosacral ligaments run backward from the uterus in a direction practically parallel with the vagina. Through this tension they undoubtedly also act through the cervix on the vagina, helping to keep up its upper end. The fascial attachments of the bladder and vagina to the pelvic wall anteriorly form with the uterosacral ligaments through the medium of the cervix an anteroposterior beam of considerable strength.

The vaginal attachment is, it seems to me, a very important support of the uterus. The vagina is slung in the pelvis by the fascial layers around it, and by its attachment to the bladder, urethra, etc. The uterus being attached to the upper end of its wall is, in consequence, also supported.

Schultze corroborates this view. He says that the fixation of the vagina and its immediate surroundings is an essential factor in securing the position of the uterus.

From an anatomic standpoint it is evident, therefore—

(a) That the uterus does not merely rest upon the pelvic floor as a chair or table rests upon a house floor, as Hart says it does, but that, through its cervical portion, it is embedded in and forms part of the pelvic floor.

(b) That, being suspended by its vaginal and bladder attachments, by the broad and uterosacral ligaments, it, therefore, as part of this suspension-bridge arrangement, helps to resist the intra-abdominal pressure in the same manner, though not in the same degree, as the bladder. This resistance is less than that offered by the fascial layers lower in the pelvic floor.

3. THE FLOOR STUDIED BY FROZEN SECTIONS.

The following appearances are presented when a vertical mesial section of the frozen cadaver of a nullipara is studied.

The pelvic floor stretches from pubes to sacrum, broken only by the urethra, vagina, and anus. The vagina is a closed slit running practically parallel with the brim, and may be considered as dividing the floor into two parts—the pubic and sacral segments. Excluding the uterus, the former has a triangular shape and the latter an irregular quadrilateral shape.

The pubic segment may be described as consisting of bladder, urethra, anterior vaginal wall, and bladder-peritoneum. Its attachment to the pubes is a loose one, being separated from it by a pyramidal mass of fat; the posterior bladder-wall is loosely attached to the anterior vaginal wall, while the urethra and anterior wall are closely blended.

The sacral segment consists of rectum, perineum, posterior vaginal wall, and strong resistant muscular and tendinous tissue, the posterior vaginal wall and anterior rectal wall being loosely connected, as far down as the apex of the perineal body.

Berry Hart, from whose work this description has been taken, makes the following statements regarding the floor:

"The pubic segment is loose in texture, has only a loose bony attachment anteriorly, and will evidently permit of mobility in an up-and-down direction. The sacral segment is made up of dense tissue, is strong in structure, has a strong dovetailed attachment to the sacrum, and is only movable downward when it revolves round the sacrum and coccyx as a whole." The weakness in the floor, due to the presence of the vagina, is in the virgin practically of no importance. The pubic segment cannot slip past the sacral because it is firmly pressed against it, the pressure acting at right angles to the vagina.

These are the data upon which this author has chiefly based his explanation of the mechanism of parturition, and to a considerable extent that of prolapsus uteri.

Where are the fallacies in this view of the floor?

A false impression as to the anatomic nature of the floor is given as well as of its mechanics.

(a) The floor is only divided into these segments by the width of the vagina. The average width varies between, say, 1 inch and 1½ inches; the average width of the pelvic outlet is 5 inches. The pelvic floor is, therefore, divided into a pubic and a sacral segment in only one-fourth or one-fifth of its width.

(b) Hart's description leaves out of account entirely the strong fascial layers, which I have already described, and which are so intimately connected to form the fascial framework of the floor. He describes strong tendinous and muscular tissues in the sacral segment, leaving them entirely out of account in the pubic segment. I have already shown that the visceral layers of the pelvic fascia are most strongly developed in the anterior part of the pelvic floor, while the *pubococcygeus* portion of the *levator ani* and the *transversus perinei profundus* have certainly as much influence in the anterior part as in the posterior part of the floor. Hart's description takes no notice either of the triangular ligament or of the important layer of deep superficial fascia under the skin.

These omissions are due to the fact that in sections these fascial structures appear so blended with the tissues about them that they are not distinguished.

(c) Though in the middle line the bladder is separated from the lower part of the symphysis by loose cellular tissue and fat, behind the upper part it is close to the bone and more firmly attached. But it is chiefly on each side that the pubic segment is firmly attached to the lower part of the pubes. The loose cellular tissue surrounding the bladder has not the first part to play in allowing of or limiting the movements of that organ. *It is its fascial attachments—its true ligaments.* The range of movement of which the bladder is capable is in reality chiefly the range possessed by these ligaments.

All changes in position in the pubic segment, likewise, depend primarily upon the range of movement and elasticity of its fascial attachments to the bone; secondarily, of its muscular and other attachments.

(d) The description of the pubic as resting upon the sacral segment is a conclusion based entirely upon a fallacious conception of the pelvic floor which the vertical mesial section gives, and is entirely out of keeping with the structure of the floor as determined by dissection. The two segments are intimately connected; the fascial and muscular suspensory arrangements of the floor being common to both. The artificial division of the floor is not necessary, and is of service only in aiding us to comprehend more clearly the changes which take place during labor.

The Perineal Body.—The perineal body is situated between the vagina and anus. In the mass, it appears, on vertical mesial section, triangular in shape, the base being the skin surface; the sides, the anal and vaginal walls. Its vertical height is about $1\frac{7}{16}$ inches; the base measures from before backward $\frac{3}{4}$ inch. It is misleading to regard it as a solid mass. It is really the central point of strength in the pelvic floor, the meeting-place of important divisions of the vesical pelvic fascia and of certain muscles, namely, sphincter vaginæ, sphincter ani externus, levator ani, transversus perinei, bulbocavernosus. It is important in relation to the ruptures which may occur in it.

Above the perineal body the vaginal and rectal walls are in apposition, loosely connected.

Pelvic-floor Projection.—This is the projection of the floor in the sagittal plane of the body beyond the conjugate of the outlet. It varies in different positions of the body and in various conditions of a woman's life, *i. e.*, nulliparous, multiparous, pregnant, parturient.

In the erect nullipara the greatest projection averages about 1 inch. In the multipara it is slightly less than this. The outer skin measurement from the coccyx to the subpubic ligament is in the nullipara about $5\frac{1}{4}$ inches.

4. PHYSICS OF THE PELVIC FLOOR.

In considering the physics of the pelvis, it is necessary to refer to the following factors:

1. *The structural arrangements and their relationships.* These have been fully considered.

2. *The intra-abdominal pressure.* This is the pressure exerted by the viscera on the parietes. For practical purposes it may be regarded as a fluid pressure—at right angles to all parts affected by it.

3. *The atmospheric pressure acting on the outer surface of the body.*

4. *The results of alterations in posture.*

When a fluid fills a cavity bounded by an expansile wall, the condition of the latter is affected by the fluid pressure which is everywhere at right angles to it, and also by the action of gravity, which causes the weight of the fluid to bulge the most dependent part of the sac. This is the case to a certain extent in the abdomen and pelvis.

In the erect posture the pelvic floor is acted on by the intra-abdominal pressure, and it is somewhat bulged down by the action of gravity. There is also a slight increase in the diameter of the abdomen just above the symphysis.

If the woman be placed on her head, a different state of matters is brought about. Increase of the abdominal measurements takes place near the ribs, diminution above the symphysis, and the outer surface of the pelvic floor

approaches somewhat to the bony pelvis. In this position atmospheric pressure and intra-abdominal pressure are unaltered; gravity is the cause of these changes, the intestines tending to sink toward the diaphragm.

If the woman be placed in the genupectoral position, the same changes occur as in the latter case, though to a less marked extent.

In the modified genupectoral or Sims' position the same changes, still less marked, occur.

In the Trendelenburg posture, or in the lithotomy posture with the hips well elevated, they are of the same nature.

In these alterations it must be clearly understood that no vacuum is caused in the peritoneal cavity. That is an impossibility, because the abdominal and pelvic contents are always in contact. It is only change in relationships that is brought about.

In these movements no dilation occurs in the passages through the

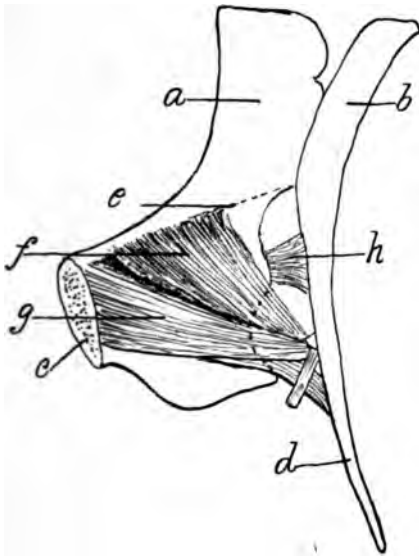


Fig. 81.—Diagram illustrating pelvic caudal muscles of a monkey: *a*, ilium; *b*, sacrum; *c*, symphysis; *d*, tail; *e*, brim of pelvis; *f*, iliococcygeus muscle; *g*, pubococcygeus; *h*, ischio-coccygeus (after A. Keith).

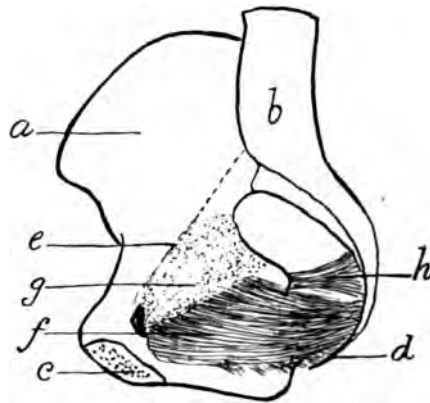


Fig. 82.—Diagram illustrating the relationships of muscles in the human pelvis, as compared with those found in a monkey (see Fig. 81): *a*, ilium; *b*, spinal column; *c*, symphysis; *d*, anococcygeal ligament; *e*, brim of pelvis; *f*, pubococcygeus muscle; *g*, obturator fascia; *h*, ischio-coccygeus (after A. Keith).

pelvic floor. They are kept closed by the two forces acting on opposite sides of the floor, namely, the intra-abdominal and atmospheric pressures, and, in the erect posture, by the action of gravity as well.

If, when the woman is placed in the genupectoral position,—*i. e.*, on her knees and chest, the hips being elevated,—the vagina be artificially opened, air rushes in and distends it. Its walls elongate; the uterus descends nearer to the promontory; the bladder is pushed partly above the symphysis. In other words, as Simpson and Hart have shown, the pubic and sacral segments of the pelvic floor are separated, the former falling downward and forward, the latter remaining unchanged save for a slight recoil upward. These changes are brought about by the action of the atmospheric pressure in the vagina.

If the perineum be held back by a finger, and light be reflected into the vagina, its walls and the vaginal portion of the cervix can be seen. The same changes occur when the woman is in the Sims' or semiprone position, and the vagina is opened up.

The rectum and bladder become distended like the vagina, when air is admitted into them, the body being placed in these positions or in the lithotomy position with the hips well elevated. By the reflection of light into their cavities they can be thoroughly examined.

NOTE REGARDING THE COMPARATIVE ANATOMY OF THE PELVIC FLOOR.

The human pelvic floor is somewhat modified from the condition found in the higher mammals possessing a tail. In the monkey, for example, the muscle which corresponds to the human levator ani acts as a tail depressor. It is described in two portions, viz., the pubococcygeus and the iliococcygeus. The former arises from the back of the pubes, the latter from the pelvic brim. This triangular sheet of muscle is inserted into the under surface of the basal tail vertebræ.

A separate muscle, ischiococcygeus or spinococcygeus, acts as a lateral tail flexor. It arises from the ischium and is inserted into the sides of the basal tail vertebræ.

In man the iliococcygeus becomes the obturator coccygeus, the line of attachment having sunk from the pelvic brim to the white line extending across the obturator foramen. The tail being absent, the levator ani is attached to the coccyx and to the soft structures in front of it. The coccygeus in man represents the inner laminæ of the ischiococcygeus; its outer laminæ are represented by the fibrous tissue of the small sacrosacral ligament.

The anterior and posterior sacrococcygeal muscles which act as elevators and flexors of the tail are represented in man by fibrous tissue and muscular remnants.

Peter Thompson says that the visceral layer of the pelvic fascia is not found in the lower mammals. In the orang-utan and chimpanzee it is partially developed, but it is not at all as complex or strong as in man. The white line of the pelvic fascia is a special development in man, being related to the erect posture; it indicates a thickening of the connective tissue giving increased strength. It is only foreshadowed in the lower primates, where the visceral fascia is fused with the upper fascia of the pelvic diaphragm.

CHAPTER II.

PUBERTY AND MENSTRUATION.

PUBERTY.

The transformation period from girlhood to womanhood is characterized by the most profound changes in the constitution. These are held to be of such importance among most races in the world that special regulations exist among them for the care and management of girls at this critical era. Some of these are of a most grotesque nature. In some African tribes, for instance, they are confined in huts and not allowed to touch the ground for periods of considerable length. In Borneo they are shut up for many months in dark cells, cut off from all intercourse with the world. In some parts of South America they are sewn up in hammocks and strictly dieted. In India a Hindu girl remains for days in a dark room, living on simple food. In many countries the girls are beaten severely, cut with knives, or exposed to the bites of insects, in order that a supposed evil spirit, thought to be troubling them, may be driven out of the body or allowed to escape. Though many of these absurd habits are the result of primitive superstitions and religious beliefs, it is interesting to note that they enjoin simplicity and quietness of life while the girl is in the transition period.

Systemic Changes at Puberty.—These are *psychic* and *physical*.

1. *Psychic*.—The character of the girl gradually changes. Her tastes, which have hitherto been those of her young brothers, from whose general physical configuration her own does not greatly differ, now become greatly changed. The romping, rollicking girl becomes shy and retiring; new desires and emotions take possession of her; womanly characteristics appear. Sex asserts itself.

2. *Physical*.—The breasts, pelvis, and neck enlarge; hair develops over the pubes and in the armpits; the voice alters; the angular, gawky girl develops into a creature of graceful and symmetric curves. The hitherto inactive and incapable generative organs take on new activity. The body of the uterus rapidly increases in size; the ovaries expel ripened ova (this feature usually develops shortly before the other phenomena of puberty). A discharge of blood takes place from the genital passage—the menstrual flow. This occurs at intervals, and continues throughout sexual life.

Age of Commencement of Puberty.—This varies considerably, and is influenced by different factors.

1. *Climate*.—In warm countries it is earlier than in cold ones. In the temperate regions it varies from thirteen to fifteen. Thus, in Lapland, the age is about eighteen; in France and England, about fifteen; in southern Egypt and Sierra Leone, ten.

2. *Race*.—Racial influences are important. They tend to be preserved even under altered climatic conditions. Thus in Jewesses the average age of

commencement is the same throughout the world. (It is earlier than the age in temperate regions.) English girls in India preserve the temperate European type. Africans in Europe retain their own type. Race is probably, therefore, a more important factor than climate.

3. *Environment*.—Puberty is earlier in city folk than in country people. Luxury and rich living tend to hasten, poverty to retard, its onset. De Boismont found that in Paris the average age among the poorest laboring classes was sixteen years one and one-half months; among the well-to-do middle classes, fifteen years two months.

4. *Sexual Stimulation*.—It is widely believed that too early stimulation of the sexual instincts leads to a premature establishment of puberty. It is difficult to prove this, however. Many cases cited are no doubt those in which puberty and sexual instinct have been early developed.

5. *Heredity*.—In some families peculiarities may be transmitted from generation to generation, *e. g.*, abnormally early development.

6. *Individuality*.—Statements are made regarding the influence of size, build, complexion, etc., on the onset of puberty, but these are not at all reliable.

Prematurity of Puberty.—In some cases all the physical signs of puberty, *e. g.*, changes in breasts, general contour, menstrual flow, etc., may develop very early. A few cases are on record where they were noted before the age of five. In several instances children have been born with all the ordinary marks of puberty. In some cases menstruation may occur with few or none of the other signs. In other cases may be found the development of hair and breasts, without change in bodily contour or without menstruation.

We do not know what changes occur in the internal genitals in all these early cases. It is certain that pregnancy has taken place at the early age of nine. We do know that in some cases ova may be shed at a very early period, and that the uterus may develop prematurely.

We are not certain as to the relation of pathologic conditions to the early appearance of puberty. In several cases where postmortem examinations have been made, various conditions have been found, *e. g.*, cystic ovary, sarcoma of the ovary, hydrocephalus, rickets. In many cases, however, no abnormal conditions have been found.

Delayed Puberty.—Sometimes puberty may be delayed in all its manifestations as late as the age of twenty-five. Many variations are found, however, as regards the various phenomena. Sometimes all may be present save menstruation. It is important to bear in mind that delay may be caused by pathologic conditions, *e. g.*, anemia.

First Onset of Menstruation.—Sometimes the first menstrual discharge appears suddenly, lasts for a few days, then stops, and reappears after an interval of three or four weeks, when the duration and quantity of the flow are the same as at first; in other words, the menstrual type and habit may be established at once. Usually, it is a gradual process. Thus, the only indications may be a feeling of fulness, heat, or pain in the pelvis; chills or flushes of heat in different parts of the body. The girl may feel drowsy or irritable, may suffer from headache and neuralgia, may lose her appetite, and may have disordered stomach and bowels. There may be swelling and tenderness in the breasts, and a white, mucous discharge from the vagina.

These symptoms may occur at regular or irregular periods before any discharge of blood occurs, and may take place in small amounts, gradually increasing at successive periods until the permanent habit is fixed.

In some cases there may be a discharge of blood at the first period and none afterward for several months. In other words, menstruation may be established gradually, intermittently, or suddenly.

It must be remembered that certain pathologic states cause many of the disturbances found in connection with the onset of puberty.

Relation of Puberty to Nubility.—Though the reproductive life begins with puberty, the girl is not then fitted for marriage. Womanhood is reached only after years of slow and gradual growth. In the temperate regions of the world, there can be no doubt that the ripened condition of maturity is not reached before the age of twenty or twenty-one. It is only then that the standard of development is reached which is compatible with the most successful bearing of the grave responsibilities of wifehood and motherhood. The too early exercise of the reproductive function leads to increased suffering on the part of the mother, depresses her vitality, and increases her liability to disease.

Bertillon's figures show the chances of death are much greater when girls marry below twenty. The offspring are apt to be ill developed, and die in large numbers in early life; only a small percentage live long and robust lives.

Breeders of animals know well that the union of immature parents produces a feeble or stunted progeny. Dogs thus born are delicate, and are usually killed by the distemper. Many dog-raisers destroy the first litter of a bitch even if she be nubile, because they have observed that the first puppies are rarely of the best quality. It was noted by Aristotle that the Greeks who married very early had small and weakly children. In France it has been observed that when fear of the conscription has caused many young people to marry, the offspring have been small and lacking in vigor.

Among the offspring of immature parents there is a larger proportion of idiots, cripples, criminals, scrofulous, insane, and tubercular than among children of nubile parents.

Disorders of Puberty.—Besides the normal disturbances which I have described, there are certain conditions, more or less grave in nature, which are apt to be developed in connection with this period.

Amenorrhea is common. It may be manifested either by a delay in the appearance of menstruation after the other signs of puberty have developed, or in the diminution or cessation of the menses after they have been established. Anemia is present in the great majority of these cases, and is undoubtedly the cause of the amenorrhea. The causes of the anemia are not clear in all instances, but in many cases they are overwork and imperfect nutrition among the poor, overstudy and insufficient or irregular exercise among the well-to-do.

In some cases the amenorrhea may be due to some general disease which has reduced the general health. In other cases it may be due to some local pelvic trouble, such as atresia of some part of the genital tract. Sometimes it may be due to an abnormal rate of physical development.

Slight attacks of mental and nervous derangement are not uncommon, especially where there is some predisposition to neuroses; these are most apt to be marked where the general health and nutrition are poor (Clouston). These conditions may afterward pass into insanity, but it is to be noted that the gravest forms of insanity are rarely developed at the period of puberty. Clouston points out that the chief neuroses met in the prepubescent period, namely, from seven to fourteen, are mainly chorea, somnambulism, asthma,

migraine, some eye defects, and some amount of epilepsy; in the period from fourteen to twenty-five epilepsy, hysteria, adolescent insanity, instinctive immorality, arrested body growth, ugliness, joint disease, ingrowing nail, acne, many skin diseases, many forms of impaired vision, barrenness, and perhaps phthisis and acute rheumatism.

MENSTRUATION.

When thoroughly established, menstruation may be described as a cyclic change, with general disturbances, and marked by local (pelvic) phenomena, not yet definitely known, of which the most evident is the loss of blood from the cavity of the corpus uteri.

General Phenomena.—Different general symptoms are found in women. Great variations are found as regards the degree in which they are present. It is hard to determine to what extent women are affected, owing to the marked differences in their nervous organizations. Some feel acutely distressed of which others scarcely complain. The following symptoms occur: nervous and gastric disturbances, tenderness or swelling in the breasts, sensations of heat and cold, torpor or oversensitiveness, fulness of neck, pain or throbbing in head and neck. In many women none of these are present.

Just before the flow the urea excretion reaches the maximum; afterward, the minimum. The temperature rises half a degree above the average before the period, falls during the flow, and goes down to half a degree below the average immediately after the period. The pulse-rate and arterial tension run a corresponding course.

Locally, there is a feeling of weight and fulness in the pelvis, irritability about the bladder, discomfort about the local parts, tenderness or pain in the lower part of the belly, and bearing down in the back.

Local Pelvic Phenomena.—The outer surface of the external genitals becomes more oily, there is an increased flow of mucus from the vagina, often associated with a peculiar penetrating odor. This period is often called the *invasion stage*. Then the mucus becomes tinged with blood, and soon the full bloody discharge is established. This lasts for a varying number of days, and is known as the *persistence stage*. Gradually the discharge becomes paler in color, but very turbid. It soon clears and there is left only the secretion of mucus. This is the *stage of decline*. Normally, no clots occur in the discharge.

Physical Changes in the Pelvis.—1. There is general congestion of the viscera. 2. In the Fallopian tubes there is congestion, and sometimes extravasated blood may be found in the mucosa. Rarely does the latter escape into its lumen; this is apt to take place in cases of genital atresia. 3. In the ovaries ovulation may or may not be found to have recently occurred, or to be in progress, for though the ovaries are essential to menstruation, the escape of an ovum is not a necessary preliminary to each period. 4. In the uterus. We are not yet in possession of sufficient facts to warrant a complete account of the changes which are found in the uterus, though for the most part they are well ascertained.

The most valuable information has been obtained from the study of uteri removed intact before, during, and after the period.

PLATE I.



Fig. 1.



Fig. 2.



Fig. 3.

Fig. 1.—Section of the uterine mucosa about fifteen hours after the onset of menstruation. Capillary dilatation and serosanguineous exudate into the interglandular tissue are found.

Fig. 2.—Section of the uterine mucosa about sixty-five hours after the onset of menstruation. The serosanguineous exudate near the surface (subepithelial hematoma) is well marked. In places the blood has broken through the surface epithelium.

Fig. 3.—Section of the uterine mucosa the day after menstruation. The subepithelial exudate has disappeared and the capillary dilatation is less marked.

1. *Premenstrual Changes*.—Several days (seven to ten) before the flow commences swelling of the mucosa of the corpus uteri occurs. Leopold states that it may become twice as thick. The vessels are congested, and an increased transudation of serum takes place into the spaces of the interglandular tissue. The glands become stretched, and abundant mucus is poured into their lumina. Many of the epithelial cells appear swollen. Dilation of vessels occurs, especially in the superficial part of the mucosa, and many of the endothelial cells are swollen. In places the serum is stained red, owing to the escape of blood from capillaries. The blood tends to spread in the interglandular tissue, accumulating at intervals under the surface epithelium (subepithelial hematoma of Gebhard). It may also enter the lumina of glands.

2. *Escape of Blood*.—Here and there the continuity of the surface epithelium is broken, the blood escaping in small quantities into the uterine cavity. A few cells may be loosened and carried with the blood. The escape of macroscopic portions of the mucosa occasionally occurs, but is to be regarded as pathologic. Fatty degeneration of cells previous to rupture is not found, contrary to the opinion so long held. The rupture of the surface epithelium may be due to the pressure of the subjacent blood, aided, possibly, by molecular changes in the cells of a degenerative character, due to interference with their nutrition. Mandl has described mitotic changes in the epithelium of glands during the period.

3. *Stage of Disappearance*.—Toward the end of the flow fatty degeneration may be noticed in the superficial part of the mucosa. The latter becomes gradually less congested and swollen. The extravasation of blood ceases, and that which was poured out is reabsorbed. The epithelium which was elevated sinks down again. Some portions may degenerate. Regeneration of destroyed cells gradually takes place. Pigment may be left in the areas occupied by extravasated blood. Westphalen states that the regeneration period lasts sixteen days.

Along with the changes described in the mucosa, certain changes take place in the musculature. It becomes congested, softened, and enlarged previous to and during the greater part of the menstrual flow.

The cervical mucosa does not undergo the changes described above. It is congested and pours out more mucus. The canal of the cervix widens during the flow, reaching the maximum, according to Herman, on the third or fourth day.

It is interesting to refer to the researches of Heape, of England, concerning menstruation in monkeys. His investigations embraced the *anthropomorpha* as well as the *lemurs*, and some of the *simiada*. The menstrual cycle is divided by him into four stages: rest, growth, degeneration, regeneration. These correspond to those in the human female. In the growth period there was swelling of the superficial portion of the mucosa, mainly due to increase of stroma, the nuclei multiplying by amitotic division and fragmentation. There are congestion of blood-vessels and widening of glands.

During degeneration the epithelium, stroma, and blood-vessels hypertrophy and amyloid degeneration of the superficial mucosa occurs. Congested capillaries rupture, causing blood extravasation. The latter leads to the formation of lacunæ, raising up the epithelium, which degenerates and breaks down, allowing the blood to enter the uterine cavity. Portions of stroma,

glands, and the superficial epithelium may be carried away, the denudation being much more marked than is found in the human female.

Bland Sutton has also carefully examined menstruating uteri in macaque monkeys and baboons, and found only congestion and loss of blood, without even shedding of epithelium.

Menstrual Type.—By this term is meant the periodicity of the process. In about 86 per cent. of women the type is *regular*, *i. e.*, menstruation occurs at regular intervals. It is calculated in terms of the number of days from the beginning of one period to the beginning of the next. The most common is the twenty-eight-day type, *viz.*, in about 71 per cent. of cases. In 14 per cent. it is the thirty-day type. In some cases the twenty-one-day type is found, and a few others occur.

In a certain percentage of cases the type is irregular, though the women are perfectly healthy. The following history was obtained from a patient who came under the writer's care several years after the menopause. Her menstruation began at fourteen. It was of the twenty-eight-day type until the age of eighteen. She then had typhoid fever. Thereafter the menstrual interval varied, being two, four, six, or eight weeks, the duration varying also from one to seven days. She was never pregnant, never suffered from pain or ill health of any kind until several years after the climacteric.

Menstrual Habit.—By this term is meant the duration and quantity of the flow. Normally, considerable variations are found. Thus it may last from two to eight days; occasionally for nine days. A large number of women have a discharge of blood for a week; many for three or four days. In health, the amount lost is generally about the same in succeeding periods. It is difficult to estimate the amount accurately; the average amount is said to be from six to eight ounces. Estimation by means of diapers is unreliable.

Very rarely healthy women are found who lose blood for less than two days or for more than eight. These extreme cases are mostly pathologic.

Physiologic Absence of Menstruation.—Menstruation is absent normally before puberty, in the intervals between the irregular discharges common during the establishment of the menstrual function at puberty, during pregnancy and lactation, in the intervals of the "dodging-period" at the change of life, and after the menopause. Sometimes, from various causes, there may be a discharge of blood from the vagina during pregnancy or lactation.

Vicarious Menstruation.—For a long period it has been believed that a discharge of blood, of the nature of the menstrual flow, may take place from parts of the body other than the mucosa of the corpus uteri in certain cases. Gould and Pyle have collected a considerable number of these. These discharges may occur regularly or irregularly, usually when the regular menstrual flow ceases or becomes irregular. It is very likely that in certain instances the hemorrhages are due to some pathologic cause, *e. g.*, purpura. At any rate, the phenomenon is a very rare one. The discharge has been described as taking place from wounds and sores of the skin; from various parts of the normal skin, as a kind of bloody sweat; from the eyes, nose, mouth, ear; from the breasts. It has also been reported as coming from the bladder and rectum.

The author has recently had two cases in his care in which periodic vicarious discharges of blood occurred, necessitating removal of the ovaries, which were in both cases considerably diseased. The hemorrhages thereafter ceased.

THE CLIMACTERIC.

One of the most important periods in a woman's life is that which is marked by the cessation of sexual activity. Various terms are employed in addition to the one above used, *e. g.*, "the change of life," "critical time," "turn of life," "menopause."

The phenomena met at this period are so varied in character, the changes in the whole system of the woman are so profound, and the distinction between the normal and the pathologic is so ill defined, that the student should give the most thorough attention to the whole range of signs and symptoms which occur, not only for their scientific interest, but because of their great importance in relation to the practice of medicine. The greatest blunders are made continually by physicians as a result of careless observation and inattention regarding this period of a woman's life. What is natural may be treated as disease, and, on the other hand, pathologic processes may be overlooked because the symptoms produced by them are thought to be merely phenomena of the menopause.

The age at which the climacteric occurs varies greatly, the range of variation being more marked than in the case of the development of puberty. In temperate regions it takes place in about 50 per cent. of women between forty-five and fifty; in 25 per cent. between forty and forty-five; in $12\frac{1}{2}$ per cent. between thirty-five and forty; in $12\frac{1}{2}$ per cent. between fifty and fifty-five. In some cases the menopause may develop prematurely, *e. g.*, under thirty, or may be abnormally late in appearing. It is impossible to state accurately what is the essential factor in inducing the climacteric, and what marks the limits of its duration. It is rarely quickly established, generally the phenomena which characterize it being *en evidence* for an extent of one to three years.

The factors determining the appearance of the change of life are not well understood. It is usually later in cold than in hot climates. It is believed to be earlier in the hard working and poor than in the luxurious and rich. Racial peculiarities are found, *e. g.*, the Jews show the same tendency to early menopause in all parts of the world. The relation to the onset of puberty is not clearly known. It is stated by some that there is no special law of relationship; by others it is believed that when puberty appears early the menopause will also be early; others think that the earlier menstruation appears the later it ceases.

Structural Changes in the Body.—Atrophy of the ovaries occurs, the Graafian follicles gradually becoming destroyed, and the connective-tissue elements becoming more fibrous. The germinal epithelium on the surface disappears. The outer part of the cortex forms a sclerosed layer, to which the term *tunica albuginea* has been applied. It is quite firm and hard. The ovaries may be reduced to one-fourth or one-fifth their normal adult size. Kisch states that the changes take place from without inward. In the Graafian follicles he points out that fatty and granular changes occur in the membrana granulosa and ovum, so that they are completely destroyed. The walls of the cavity are gradually pressed together, the débris being absorbed. These changes may take place quickly or they may be prolonged over years. There can be no doubt that their functional activity may continue in some cases long after menstruation has ceased, for pregnancy may take place at that time.

The uterus becomes smaller and its walls thinner. The cervix gets shortened, and may remain hard or flabby. The whole organ may be reduced to the length of an inch and a half or less. The cervix becomes a knob-like projection or may be felt as a mere dimple in the fornix. It is not certain as to whether the cervix and body shrink simultaneously, or whether one part changes more rapidly than the other. Excessive congestion of the mucosa and increased secretion of mucus are common in the early stages of the menopause. Later they gradually disappear. The mucosa thins, the glands getting gradually obliterated and fibrous tissue developing. The lining epithelium becomes flattened and, in parts, destroyed. Adhesions may take place between apposed mucous surfaces.

Hegar and Krieger state that the uterine changes follow the atrophic changes in the ovaries.

The vagina becomes gradually contracted, especially in its upper part, and often assumes a conic shape. The introitus becomes smaller, especially in virgins and nullipara. It may be marked by a rigid ring of tissue. The rugæ gradually disappear. At first its walls are congested, and then, as its vessels atrophy in places, it has an irregularly mottled appearance; afterward it becomes quite pale.

In multipare with relaxed tissue prolapse of one or other part frequently occurs at this time.

The Fallopian tubes atrophy, and the lumen gets often more or less obliterated. The external genitals gradually lose their fat and atrophy, the labia becoming thin folds of skin. The connective-tissue elements become tougher and less capable of being stretched than in early life.

The body-contour alters somewhat. It may become less graceful, owing either to disappearance of fat or to great deposition of fat. Sometimes it becomes somewhat masculine in type; the skin may get coarser, and hairs may develop on the chin. The milk-glands atrophy, and the breasts may be changed to thin flabby masses, but if the body takes on fat they may become turgid and large. There is generally less activity in the blood-forming tissues, some of which shrink and harden. "Life becomes slower," as one author expresses it.

Menstruation comes to an end. This occurs in a variety of ways. In some cases the intervals between the periods lengthen: in others they are shortened. The flow may increase in quantity or duration or in both; it may be diminished; or it may be irregularly greater or less, often alternating in quantity. Between the periods there may be occasional small losses of blood, continued dribbling, or sudden large losses. The cause of climacteric hemorrhages is not always certain. In the majority of cases definite pathologic lesions are present, *e. g.*, displacement, inflammation, new-growths, etc. But frequently these are absent, and it is not easy to explain the hemorrhage. It may in some instances be caused by local dilation of vessels from vasomotor weakening leading to marked congestion of the mucosa. Sometimes it may be associated with arteriosclerosis and hemorrhagic infarction, as suggested by Findley. Sometimes menstruation may suddenly come to an end. In other cases it may gradually diminish and cease. In most cases the above-noted irregularities occur, the name "dodging-period" being given to the time in which the menstruation occurs at irregular intervals.

General Phenomena.—The greatest variations are found as regards the general phenomena met at the menopause. Currier states that in races or nations which are phlegmatic, cold, and apathetic, in women accustomed to life in the open air and to hard work, in savage and barbarous nations, the disturbances of the menopause are slight. Whereas, among emotional, passionate people, like the Latin nations, among women of nervous temperament, city-bred, strenuous, the distressing phenomena of the climacteric are usually found.

In some cases the woman may present no peculiarities whatever to distinguish her from what has been considered as her normal habit. In the great majority of instances, however, marked characteristics are developed, which may be noticeable not only to the woman, but to her friends and physician. Changes may be brought about which affect all the functions of the nervous system, *e. g.*, mental, motor, sensory, coördinating, etc. Generally, she feels less inclined to indulge in her past activities. She is more easily bored and worried. Sometimes her tastes and disposition may entirely change. A vivacious and impulsive nature may become calm and melancholy, or a quiet, subdued nature may develop a tendency to irritability and impatience. Often the power of concentration of the attention is greatly lessened, and there may be forebodings of sickness, disaster, etc.

Some women suffer from a feeling of heaviness in the head; they may be dull and stupid, and inclined to sleep. Sometimes a condition of stupor may last for hours. Loss of memory is often met, and the woman may forget the names of those very dear to her.

There may be an abandonment of self-control or a fear that it will be lost. A woman may lose all interest in those she loves, and may even try to harm them, or she may be suspicious that they wish to injure her. Sometimes suicidal and homicidal tendencies are induced, but they are not strongly marked. There may be developed perversion of tastes; thus a woman who has always been temperate may be filled with a keen desire to drink alcoholic liquors.

Forced ideas may develop, in varying degrees of intensity and for shorter or longer lengths of time. Thus a woman may believe that she is to lose her reason, that she has a tumor. Or they may be of the nature of such a case as that reported by Börner, in which a woman believed that something was wrong with her bladder. She always took a seat near the door at a public entertainment, in order that she might retire easily if the desire to urinate should seize her. Gradually she gave up going out of her house altogether, from fear of not being able to hold her water.

The changes in disposition may be manifested intermittently or continuously. Thus, when ill-temper develops, it may exhibit itself in an occasional outburst or continuously. Changes may be found in the sexual relationships. The former vivid consciousness of sex differentiation becomes less marked. The influence of one sex on the other is less keen and subtle. The sexual appetite very often disappears more or less completely and suddenly or gradually; and, as Clouston says, "with it the affectiveness changes in its object and greatest intensity from the mate to the progeny, losing its imaginative force, its fire, and its impulsiveness." Sometimes sexual desire is abnormally intensified, and may have distressing results; this may be merely due to a con-

dition of hyperesthesia, or may be associated with a pathologic condition, such as tumor. This intensification may occasionally last long after the menopause.

Many peculiarities are found in connection with the sensory part of the nervous system. In some cases there is marked sensitiveness to bright lights, to loud noises, or to strong smells. There may be impairment in the power of determining the nature of impressions. Thus sour things may be considered sweet, or sweet things sour, and well-known smells may be entirely mistaken. Sometimes women complain of having bad tastes, of hearing strange noises, of deafness, of dimness of vision.

On the skin there may be areas of anesthesia or hyperesthesia; sometimes a feeling as if the skin were being pricked with needles. Flushings or "heats" are often met. They may affect one or more parts of the body, very often the head. They are usually most marked in nervous women, and are increased by emotional excitement, shock, great warmth, and other factors. Sometimes there may be considerable weakness or faintness during one of these heat spells.

Chills may alternate with the flushings. Sweating may also be a marked phenomenon. It may occur at irregular intervals, affecting one or other part of the body. Often one part tends to be especially affected. Sometimes it is worst at night; sometimes after exertion or emotion. It may develop along with the flushing or independent of it. Itchiness occurs in different parts, but especially on the external genitals. It varies greatly from time to time as regards its extent and location, and is usually intermittent.

Pains may be felt in various parts, *e. g.*, headache, sciatica, neuralgia, migraine. In some cases a woman who has suffered in her past life from these conditions may be cured by the menopause.

Sometimes the chest or belly is the special seat of pain. Attacks like angina pectoris may develop. Palpitation of the heart may be very troublesome. There may be a tendency to faintness and vertigo. Disturbances of the alimentary tract are common. If a woman has suffered from these in the past, she generally complains more at the menopause, though, sometimes, improvement sets in then.

Cramps may occur in various parts of the body. These may affect the throat, interfering with speaking or swallowing. There may be stiffness or weakness in joints and muscles. In some cases well-marked hysteric convulsions take place. True epilepsy may develop, though probably only in those with some hereditary taint or in whom it had occurred in early life.

It is very evident from the consideration of the above-mentioned phenomena that they may be regarded as falling under the heading of "neuroses." What the essential change is that brings about the altered condition of nervous stability we do not know—probably it is related to metabolic changes.

There can be no doubt that the symptoms are aggravated by various organic disturbances which may exist at the time of the menopause. Anemia, for instance, is very common, and may have a marked influence in determining certain distressing symptoms. Stomachic, pelvic, or other diseases may exist.

The Menopause in Relation to Special Diseases.—I have already pointed out how certain mental diseases and epilepsy may be induced at this

period. Certain skin affections may develop, especially acne, herpes zoster, eczema, urticaria, pruritus; the last is in some cases due to actual changes in peripheral nerves or end-organs. Kraurosis vulvæ is often found. Disturbances of the alimentary tract resulting in vomiting, heartburn, constipation, etc., may be induced; preëxisting troubles may be intensified. Sometimes they may improve or disappear.

It is important to note that the menorrhagia and metrorrhagia which I have described may be aggravated by the existence of such conditions as inflammations in the pelvis, subinvolution of the uterus, displacements of the uterus, new-growths of that organ. It is, therefore, very important that these conditions should not be overlooked. Fibroids are very common causes of bad bleedings at the menopause. Carcinoma of the cervix is most frequent about this period.

Newman has analyzed 500 cases of disease after the climacteric had been established a year or more. The following table gives his results:

DISEASE.	WITH HEMORRHAGE.			WITHOUT HEMORRHAGE.		
	Number.	Average age.	Age at which menopause occurred.	Number.	Average age.	Year of menopause.
Carcinoma cervicis uteri.....	100	56.2	47.7	3	70.3	48
Prolapse of vagina or uterus	24	59	43.6	88	59.2	47.6
Carcinoma corporis uteri.....	18	57.4	49.5	..	..	..
Mucous polyp of uterus.....	8	55.4	47.25	..	..	..
Senile changes in genitals.....	5	63.6	49.4	80	54.2	46.7
Myoma uteri.....	4	68	51.3	10	53.3	49.4
Ovarian cyst.....	4	54	45.5	21	58.2	47.7
Doubtful conditions.....	20	61.7	47.4	20	58.5	46.1
Displacements and inflammations of uterus.....	..	..	..	35	49.2	47.5
Other affections of genitals .....	..	..	..	60	58.8	44.8
	183	56.5	46.5	317	56.1	46.9

It thus appears that out of these 500 cases 183, or 36½ per cent., had a return of hemorrhage after the menopause had been established a year or more. Of these, cancer caused the bleeding in 54 per cent. of the cases.

The Question of Early Climacteric.—It is generally believed that very few cases of premature establishment of the menopause occur under normal conditions, but that most are pathologic in nature, being due to such conditions as the following: sudden shock, great anxiety, extreme exhaustion, anemia, severe cold, tuberculosis, exanthemata, septicemia; various poisons—*e. g.*, alcohol, opium, phosphorus, arsenic, mercury; inflammation of the uterus and appendages; new-growths in the ovaries; obesity. It is impossible, however, to speak with any accuracy regarding the influence of these various conditions. In some cases they seem to be absent. The metabolism of the body may be profoundly altered by some general influence on the nervous system, or reflexly through local irritation, *e. g.*, inflammatory changes in the ovaries.

I have met one case in which menstruation began at eighteen and ceased at twenty-one, there being no ill health. Mayer reported two cases in which menstruation ceased at twenty-two. In one of these three children were born after cessation.

Delayed Climacteric.—As I have already stated, there is undoubtedly evidence that sexual activity may be prolonged for years beyond the normal period. Menstruation may or may not be present, but ovulation may continue, and conception may take place.

Various cases have been reported in which menstruation occurred after sixty and as late as one hundred and four. Pirou in 1866 reports an instance of a woman menstruating in her seventy-second year, becoming pregnant and aborting.

Many cases described as protracted climacteric are only cases in which pathologic hemorrhages take place. These may be due to heart lesions, to uterine fibroids, carcinoma, sarcoma, adenoma, polyp, erosions of the vaginal portion of the cervix and of the vaginal walls.

DISTURBANCES OF MENSTRUATION.

AMENORRHEA.

Amenorrhea means diminution or cessation of the menstrual flow. I have already referred to its occurrence in connection with the development of puberty (see p. 111).

In the adult state it is due to all conditions in which the health is reduced, *e. g.*, anemia, Bright's disease, malaria, phthisis, fevers, etc. It may be due to sudden shock, to great nervous depression, to chills. It may result from a change of life; this is often found in girls who go from the country to the city to work; sometimes in those who go away to study; sometimes in those who go on a long sea-voyage. It may be due to developmental defects, *e. g.*, absence or rudimentary condition of the internal genitals; it may result from atresia in the genital tract preventing the escape of the menstrual blood; it may be due to cretinism; it may be caused by various pelvic diseases. It may be found in parametritis chronica atrophicans. It may accompany the anemia succeeding marked hematocele. It may be found in cases of tubal disease, *e. g.*, pyosalpinx, where the patient is much run down. It may follow acute inflammation, *e. g.*, in the exanthemata where the ovaries have been destroyed; or it may be due to gradual cicatrization and atrophy of the ovaries from chronic inflammation in and around them, or from abscess formation. In tumors of the ovaries it may be present as a result of the local condition, if the disease is bilateral and advanced.

It may be found in connection with an endometritis, where the hemorrhagic or leukorrhœal discharge has greatly weakened the patient, or with old inflammation, where the mucosa has been changed to fibrous tissue. It is found in superinvolution of the uterus. In vesicovaginal or rectovaginal fistulæ it may be brought about. In most of these it probably results from the action of the diseases in reducing the patient's health. It is found after removal of the ovaries.

It is necessary, also, to emphasize the necessity of bearing in mind the periods of normal and physiologic amenorrhea, *i. e.*, the period before puberty.

the times between the irregular discharges so common in many cases at the establishment of the menstrual function, the months of pregnancy, the time of lactation (though in some cases menstruation may occur during nursing), the intervals of the "dodging period" at the change of life, and the period after the menopause. Another important point must be attended to in this relationship, namely, the difficulties in the determination of pregnancy from the menstrual history. It is most important that the student should attend to these. Normally, when a woman becomes pregnant, her menstruation ceases, and it is customary to estimate the duration of pregnancy from her last period. Moreover, the history of the cessation of menstruation in a woman should always suggest the possibility of pregnancy, particularly in a married woman. The student must bear in mind that a girl may become pregnant before she has ever begun to menstruate; that a woman may sometimes become pregnant during a period of amenorrhea from some diseased condition, during lactation or the "dodging period" of the menopause.

Further, irregularity of menstruation may interfere with correct calculation of pregnancy. Another set of cases present difficulty, namely, those in which discharge of blood may take place during pregnancy, *e. g.*, in ectopic gestation, in pregnancy in one-half of a septate or bicornute uterus, and in certain abnormal or diseased conditions.

If these important points are forgotten, serious error may be committed, *e. g.*, a woman during the menopause, suffering from dyspepsia and flatulence, with a history of eleven months' amenorrhea, was sent to a hospital as a case of spurious pregnancy, whereas an actual pregnancy of four months' duration was found in her. A sound has been passed into the uterus of a woman during lactation and an abortion caused; as the patient was nursing, it was not supposed that she would be pregnant, and a careless examination was made.

Occasionally cases are found in which menstruation never occurs, though the genitals are well developed and the general health is good. Sterility is the rule in such women, though conception may rarely occur. Vicarious losses of blood sometimes occur. In many of these cases there are probably malformations or pathologic conditions in the pelvis.

MENORRHAGIA.—METRORRHAGIA.

Menorrhagia means increased flow of blood from the uterus at the menstrual period, and may be expressed in terms of quantity or duration, or of both. The normal variations found in women must be borne in mind. What is abnormal for one may be normal for another.

Metrorrhagia means hemorrhage from the uterus at times other than the menstrual periods. In this connection must be remembered the irregular discharges of blood often found during the period of puberty before menstruation is well established, and also during the period of the menopause. The irregularity of type in certain women in a state of health must also be borne in mind. These two conditions may occur together or independently.

In this section attention is given chiefly to their occurrence in the non-pregnant woman. They may be caused by various general disturbances and nonpelvic diseases, *e. g.*, hemophilia, scorbutus, acute specific fevers, Bright's disease, cirrhosis of the liver, heart disease, alcoholism.

Various pelvic diseases may lead to their occurrence, *e. g.*, pelvic peritonitis; hematocele and hematoma; varicose veins; salpingitis, ovaritis, especially in early stages; ovarian tumor in some cases; endometritis, endocervicitis, metritis; arteriosclerosis; retroversion and retroflexion of the uterus; inversion of the uterus; fibromyoma, sarcoma, carcinoma, and other new-growths of the uterus, prolapsus uteri, subinvolution; chronic constipation. Post-climacteric menorrhagia is referred to on p. 120.

The following conditions may lead to a discharge of blood, which may be mistaken for menorrhagia or metrorrhagia, namely, lesions of the vagina and vulva, *e. g.*, ulceration, tumors. It must be remembered, also, that certain states connected with pregnancy may lead to hemorrhages from the uterus, *e. g.*, incomplete abortion, retention of bits of placenta or membranes, placenta prævia, hydatid mole, accidental hemorrhage, inertia of the uterus.

Halliday Croom and other authors mention the occurrence of "idiopathic menorrhagia" where no cause, whatever, can be found.

DYSMENORRHEA.

By this term is meant pain associated with menstruation. In normal conditions usually no pain is felt; in a number of these cases only slight pelvic discomfort; and in others only a dull backache. When there is distinct pain, it is sharp, dull, dragging, down-bearing, or labor-like. It may be felt in the loins, in the small of the back, in the pelvis; and from these regions may radiate into the thighs. Great variations are found as regards the time of onset and the duration of the pain. Thus it may be felt only for a day or two preceding the menstrual flow, ceasing at the commencement; for a day or two before, as well as for the first day or two of the flow; during the first day or two of the flow only; during the whole extent; during the last two or three days; during the day or two succeeding the period.

At present we cannot satisfactorily distinguish the factors which determine these variations. The pain varies greatly in intensity. It may in no way interfere with the woman's regular life, or it may entirely incapacitate her for her duties.

Before considering the conditions in which dysmenorrhea occurs, it is well shortly to recapitulate certain physical factors in the pelvic phenomena of normal menstruation, so far as we know them:

1. According to Lindblom, the uterus enlarges slightly prior to the menstrual flow, and during the period is felt to be somewhat soft and lax, continuing so for a short time after the bleeding stops. The mucosa becomes congested and swollen.

2. Herman has shown that some widening of the cervical canal occurs during the flow, reaching its maximum on the third or fourth day. The widening is not at all proportionate to the quantity of blood lost.

3. The chief loss is in blood, small portions only of the epithelial covering of the mucosa being shed, and possibly very minute bits of the subepithelial connective-tissue stroma. The blood does not clot in the uterus in normal conditions, owing to the alkaline reaction of the uterine mucus, which is abundantly poured forth during the period, and owing to the continual passage outward of the flow.

4. There is general congestion of the pelvic viscera.

Ovulation is not an essential part of the process, and may or may not accompany it.

Dysmenorrhea is found in two sets of conditions: 1. Associated with various pathologic or abnormal conditions in the pelvis, recognizable on physical examination. 2. When no pelvic lesions, or only slight ones, can be made out.

IN RELATION TO CHANGES IN THE PELVIS RECOGNIZABLE ON PHYSICAL EXAMINATION.

1. Associated with Chronic Pelvic Peritonitis and Cellulitis.—These varieties of pelvic inflammation are related to dysmenorrhea in the following ways: In some cases there is no dysmenorrhea. In other cases they lead to the formation of areas of resistance to the congestion which is general in the pelvis in connection with menstruation. The pressure of the congested vessels affects the nerves in the inflamed and rigid parts, causing pain. In other cases the dysmenorrhea may be related chiefly to the effects produced in the uterus or appendages by the inflammation.

That variety of inflammation which is most often associated with dysmenorrhea is uterosacral cellulitis. I shall consider this in relation to pathologic anteversion of the uterus. In all conditions of pelvic inflammation the association of neuroses must be borne in mind.

2. Associated with Disease of the Fallopian Tubes.—Salpingitis is often the cause of severe dysmenorrhea. The pains in the worst cases may begin one or more days before the period, and are of a spasmodic, agonizing character. When the flow begins there is very often considerable relief, though frequently the pain lasts through the whole period. The explanation of the dysmenorrhea, and of the variations which occur, is difficult. When the walls of the tube are thickened, it is possible that the premenstrual congestion causes the pain, owing to the resistance to the dilation of the salpingeal vessels due to the inflammation. Yet there are cases of well-marked interstitial salpingitis in which there is no increase of pain in relation to menstruation. Probably the worst dysmenorrhea is found with tubes moderately distended with pus. It is believed by some that the intense pain in these cases is caused by expulsive efforts set up in the wall of the tubes under the stimulus of the premenstrual congestion. It is remarkable, however, that some cases of advanced pyosalpinx occur in which there is little or no pain at or between the menstrual periods. This is also markedly true of hydrosalpinx and hematosalpinx. Moreover, the amount of pain is not at all proportionate to the degree of distention of the tubes. Of great importance in these cases is the influence of the pelvic condition in inducing neurotic symptoms.

3. Associated with Disease of the Ovaries.—*Inflammation.*—The relation of pelvic pain and dysmenorrhea to ovaritis is little understood. It is impossible to eliminate the influence of periovaritis, or of perisalpingitis and salpingitis, with which the former condition is often associated. There is no doubt, however, that ovaritis, especially if associated with periovaritis, may cause dysmenorrhea of varying degrees of intensity in different cases; though sometimes it may not be marked by any special pain in relation to the

menstrual period. Perhaps the most common type is that characterized by the exacerbation of the already existing pain a day or two before the flow, continuing throughout the period. Very often, however, the dysmenorrhea develops only at the beginning of the flow; in some cases it is continued for some days after the period.

So far as we know, the exacerbation of pain in connection with menstruation in cases of ovaritis can only be explained on physical grounds by the occurrence of congestion in an isolated organ whose expansibility is interfered with by inflammatory changes in or around it.

For a long time the term "ovarian dysmenorrhea" has been applied especially to the cases in which the pain is most marked before or just at the beginning of menstruation, it being supposed that the pain is due to the process of ovulation. I object strongly to the use of this term in such a connection. In the first place, there can be no doubt that the special type of pain here referred to is most marked in cases where severe tubal inflammation exists, so that no distinction whatever can be drawn between salpingeal and ovarian dysmenorrhea. In the next place, while it is no doubt true that the escape of an ovum in marked ovaritis or periovaritis is associated with an exacerbation of pain, there is no reason whatever to believe that this process goes on in the majority of the cases of inflamed ovaries in which this special type of dysmenorrhea is found. Ovulation may sometimes happen to coincide with the beginning of menstruation, but in most cases it does not. There is no necessary coincidence in the occurrence of the phenomena.

It is necessary to point out with great emphasis that the most marked cases in which reflex neuroses are established or aggravated are those in which the ovaries are the seat of troublesome inflammation. It is, therefore, difficult in any given case to establish a proper relationship between the physical and the neurotic.

4. Associated with Affections of the Uterus.—(1) *Malformations.*—In uterus septus and uterus bicornis, if one-half of the uterine cavity is atresic in its lower part, dysmenorrhea occurs in association with the accumulation of menstrual blood in the part which is shut off. The same symptom is met when accumulation occurs in the rudimentary horn in a case of uterus unicornis. Dysmenorrhea begins in the pelvis on the affected side at puberty. With succeeding periods the pain usually becomes more marked and more prolonged; it is often like labor-pains.

(2) *Stenosis of the Cervix.*—For a long time one of the most common causes of dysmenorrhea has been thought to be a narrowing of one or other part of the cervical canal, causing a mechanic obstruction to the escape of the menstrual flow. In some cases the os internum, in others the os externum, may be the special seat of contraction. Sometimes both may be at fault, or, indeed, occasionally the whole cervical canal may be narrowed.

The most erroneous ideas are prevalent in regard to this matter. No definite standards have been set up as regards the size of canal necessary to a painless passage of blood. No account has been taken of the fact that during menstruation the whole cervical canal becomes somewhat dilated. Measurements made, therefore, between the menstrual periods will not apply to the uterus during their progress.

It is interesting to note that one observer, Burton, passed the sound into the

uterus at the menstrual periods in six cases of dysmenorrhea, said to be due to stenosis of the cervical canal. In each instance he found that the sound passed very easily, the canal being much more patent then than between the periods. Similar observations have been made by the author.

It is extremely rare to find a case in which, in intermenstrual periods, a sound cannot be passed into the uterine cavity. The percentage of cases of dysmenorrhea attributable to contraction, however, is very considerable. Moreover, the results of treatment based upon the prevalent hypothesis are very unsatisfactory, *i. e.*, dilation or division in a very large proportion of cases causes no improvement. In some cases of cure there can be little doubt that the operation has acted, not by its direct influence on the uterus, but by its influence in counteracting a neurotic condition from which the patients have been suffering. In other cases, in which the dilation has caused an improvement, the dysmenorrhea has been due, not to the attributed stenosis, but to the fact that there is an abnormal tendency to clotting of blood *in utero*, to fibrin formation, or to the shedding of abnormally large portions of the uterine mucosa.

I wish particularly to emphasize the latter point. It is a well-known fact that occasionally a complete cast of the mucosa of the body may be expelled during a menstrual period, and though the cervical canal is normal and undergoes considerable dilation, the most intense dysmenorrhea is induced. Now, there is, I believe, a proportion of cases in which bits of the mucosa of various sizes are expelled as a regular or irregular habit. And it is to these that the narrowing of the canal is due, interfering with the free escape of the menstrual blood. It does not require a large portion of tissue to block the cervical lumen at the upper or lower end.

It is extremely likely that in cases of dysmenorrhea, said to be due to spasmodic contraction of the os internum or os externum, the contraction is induced by the presence of a detached portion of mucosa within the circle of muscle. This can be easily understood when one remembers how, in passing a sound into the uterus, it may often be held very firmly by a spasm of the musculature at the os internum. I am, therefore, of the opinion that a considerable proportion of cases of dysmenorrhea should be classed as "membranous dysmenorrhea," using this adjective to apply to portions of mucosa, great or small.

While in Edinburgh I had under observation for over a year a most interesting case of severe dysmenorrhea, in which in successive periods portions of mucosa, varying in size from a complete cast of the cavity of the body to a piece not larger than a ten-cent piece, were passed. The menstrual discharge was carefully collected and examined at each period. She had suffered for over two years, the pain varying in intensity from time to time. At some of the periods had not the discharge been most carefully examined, the true nature of the case would not have been made out.

In another set of cases dysmenorrhea is attributed to a narrowed cervical canal, when it is really due to an inflammatory condition in or near the uterus or appendages. Also the element of neurosis is undoubtedly overlooked in many instances as an important factor in producing the dysmenorrhea.

There is, therefore, but a very small residuum of cases in which it can be held that dysmenorrhea is directly and solely due to a stenosis of the cervix. These are probably instances of congenitally elongated, conic cervix of abnor-

mally small caliber, or of rigidity of the cervix induced by inflammatory changes, conditions interfering with the dilation which occurs in the cervical canal normally during menstruation.

Herman and Andrews state that smallness and rigidity of the cervix underlie the production of some cases of spasmodic dysmenorrhea not so much by causing mechanic obstruction as by preventing physiologic dilation.

3. *Inflammation in the Uterus.*—Dysmenorrhea is frequently found in association with endometritis. Under this heading must be included all the cases to which I have referred under the name of "membranous dysmenorrhea." When a complete layer of the mucosa is shed, it is due to the widespread interstitial inflammation rendering the superficial portion of the mucosa impermeable to blood. The latter escaping into the substance of the mucosa dissects off a portion. The loosened tissue is expelled by the uterus, and as it is forced down, it either breaks across or pulls after it part or the whole of the remaining superficial layer of the mucosa. The passage of the membranous masses through the cervix causes reflex spasms of the musculature, especially at the os internum, this further interfering with the downward progress of the uterine contents. The uterine wall is thus further stimulated to contraction, and so great pain is produced.

As I have already stated, apart from the shedding of complete or very large casts of the mucosa, there is probably a considerable number of cases in which small portions of different sizes are expelled, the severity of the dysmenorrhea varying greatly.

There is one uncommon form of endometritis, the villous or papillary, in which projections of tissue extend into the cavity. These may cause dysmenorrhea, either by becoming swollen with the congestion of menstruation and thus stimulating the uterus to contraction, or by being broken off and expelled, causing pain in the manner just described.

No doubt many cases of dysmenorrhea attributed to endometritis are really due to chronic metritis. In this condition the indurated state of the uterus, owing to the increased amount of fibrous tissue in its wall, opposes the softening and relaxation of menstruation, and the increased congestion leads to greater pressure on the nerve-fibers in the wall.

Great variations are found as regards the occurrence of dysmenorrhea in metritis. In some cases it is not present at all. These variations are probably dependent upon the extent and situation of the inflammation, the size of the lumen, and the amount of fixation of the uterus by outside inflammation. The latter point is of considerable importance. When a uterus is altered by chronic metritis, and firmly fixed by peritonic adhesions or cellu-litic deposits, there is the most favorable combination for the occurrence of dysmenorrhea. The condition is exactly analogous to chordae in the male, in which intense pain is produced owing to the opposition to congestion of the penis, caused by the inflammation.

This combination is most frequently found in women in the diseased state known as pathologic antelexion, associated with uterosacral cellulitis or posterior perimetritis. Here the dysmenorrhea is due, not to the flexion in the uterus, but to the inflammation in and behind the organ opposing the congestion of the menstrual period, thereby leading to marked pressure on the nerves.

Finally, in all cases of metritis, the importance of an accompanying neurosis as a factor in causing pelvic pains must be kept in mind.

(4) *Displacements of the Uterus*.—It is probable that, in the great majority of cases, displacements of the uterus *per se* have nothing to do with dysmenorrhea. If the condition of the escaping of menstrual blood be normal, there is no reason why the existence of an abnormal degree of version or flexion of the uterus should prevent the downward progress of the blood.

Schultze and Scanzoni demonstrated in a number of cases of intense dysmenorrhea associated with antelexion that there was no retention of blood in the cavity whatever. The passage of the sound was in no instance followed by any relief or by any escape of blood.

Neither is there any ground for believing that a flexion interferes with the congestion of the uterus at menstruation. The blood-vessels in the uterine wall run toward the mucosa mainly at right angles or obliquely from the vessels outside the wall, derived from the ovarian and uterine arteries, as Williams has shown. No flexion alone, therefore, can affect the circulation in the wall.

The explanation of dysmenorrhea in cases of flexion is as follows: In some cases the causes are metritis and fixation of the uterus, as held by Schultze, *e. g.*, in the condition already referred to, where marked antelexion is associated with inflammation in the uterus and behind it. The same conditions may be found in a marked retroflexion, where the fundus uteri is deeply placed in the pouch of Douglas.

It is a common clinical experience that many of these cases are improved by treatment of the inflammatory conditions present. Exact observations on this point have been made by Schultze, who points out that the dysmenorrhea may be cured as the inflammatory products are absorbed, even though the flexion of the uterus may remain exactly the same.

In another set of cases, where a very acute flexion exists, and where there is a tendency to fibrin formation or blood-clotting *in utero*, or to the exfoliation of portions of the mucosa owing to endometritis, it is not difficult to understand why there may be obstruction to the escape of the uterine contents, and consequently dysmenorrhea. In a considerable number of cases also the pain is referable to a neurotic condition. Frequently it may be due to associated ovarian or tubal disease.

That many cases of marked displacement exist in which there is no dysmenorrhea is a well-established clinical fact. Such examples indicate clearly that other factors are necessary to the production of the dysmenorrhea.

In inversion of the uterus there may be great pain at the menstrual periods. In the slowly produced variety it is easy to understand why this should be so. The inverting portion becoming congested at the menstrual period stimulates the rest of the organ to contractions, which tend to increase the extent of the inversion. In chronic conditions there are usually marked inflammatory changes in the uterine wall, which tend also to induce the dysmenorrhea.

(5) *Fibromyoma of the Uterus*.—Dysmenorrhea is a common symptom in fibromyoma of the uterus, and it occurs under different conditions.

In cases of submucous fibroids, which are tending to project into the uterine cavity, the pains are usually severe and labor-like. The polyp swells with the menstrual congestion, thus acting as a stimulus to uterine contractions. In large, pedunculated, subperitoneal fibroids there may be dysmenorrhea of a

stretching or dragging nature, due, according to Gusserow, to the distention of the tumor with blood. Great pain may also be produced when such tumors have fallen within the true pelvis, the congestion due to menstruation causing pain by increasing the weight of the tumor, by causing pressure-symptoms on surrounding structures, and possibly by stimulating the uterus to contraction. Similarly, dysmenorrhea may be caused when large interstitial fibroids cause the uterus to increase so that it fills the pelvis.

DYSMENORRHEA ASSOCIATED WITH SLIGHT OR WITHOUT ANY RECOGNIZABLE PELVIC LESIONS.

A large number of cases of dysmenorrhea occur in women without distinct pelvic lesions sufficient to explain them. In these the predominant factor is disturbed innervation in one or other of its various manifestations. (This subject is further considered in the chapter on "Neuroses in Relation to Pelvic Diseases.")

REFLEX DYSMENORRHEA.

In recent years attention has been directed to the occurrence of dysmenorrhea reflexly induced from some disturbance in the genital tubercles in the nose. It has been stated by several competent observers that the application of cocaine or the cautery to these portions of the nasal lining has been followed by relief of the dysmenorrhea.

CONSIDERATIONS AS TO TREATMENT.

In view of the variety of the conditions which are associated with dysmenorrhea, as well as the difficulty of determining accurately the cause of pain in any given case, it is evident that precise indications as to treatment cannot be given. It may be stated generally that in treating dysmenorrhea a wide range of procedures must be considered, both medical and surgical. There are cases in which the chief consideration must be given to the improvement of the general health, or particularly of the nervous system. In many instances local therapeutic measures must be adopted to diminish various forms of pelvic inflammation. Different surgical procedures may be necessary, such as dilation of the uterus, curetage, removal of tumors, corrections of uterine displacements, resection or removal of diseased ovary, etc. One of the commonest procedures employed is dilation of the cervix. This may undoubtedly be satisfactory in some cases, but it is very often a failure, because it is employed in cases in which the cause of the trouble is not cervical. Herman and Andrews have recently given a very interesting analysis of cases in which this method of treatment was carried out.

Of 67 cases cured by dilation, they found that in 43 the pain had dated from the time of puberty; in 24 it was acquired later. Of 36 cases where no benefit followed the operation, in 18 the pain dated from puberty and in 18 it was afterward acquired. They hold that primary dysmenorrhea is more likely to be cured by dilation than the acquired form. The result of treatment is not materially affected by the length of time the dysmenorrhea has lasted, the age of the patient when treated, or the duration of married life.

In three-fifths of the cases cured by dilation the time at which the pain

began was very close to that at which the flow began. In most of those not affected by dilation the pain began two or more days before the flow. The pain of pelvic congestion began earlier and lasted longer than that of uterine spasm. The former was constant, the latter intermittent.

In those cases not cured by dilation, in more than half it lasted more than four days, and in only one-fifth was it limited to two days. Of those cured by dilation, in one-half the pain lasted less than two days. In the cured cases the pain was paroxysmal in four-fifths; in those not cured it was constant in three-fourths. In some both kinds of pain were present.

MENSTRUATION IN RELATION TO MENTAL IRRESPONSIBILITY IN WOMAN.

It is held by many that in medicolegal investigations the mental condition of woman during her menstruation should be taken into account, and that inquiry should be made, in the case of a committal of a crime, whether it occurred immediately before, during, or after a period.

Krafft-Ebing states that the examination of the mental condition is especially important if any peculiarity in behavior or nervous disturbance has been noted in connection with menstruation. He insists that if that process has had a marked influence upon the ideation of the woman, that fact should be regarded as an extenuating factor in deciding the punishment, even where there is no clear proof of menstrual insanity. If a crime has been committed during menstruation, by one who had been accustomed to be mentally disturbed at this time, and if the act denotes impulsiveness, the accused should be regarded as irresponsible, in the opinion of this authority. But, he adds, that such persons pardoned on such a ground should be kept under surveillance for a time, in order that their habits might be studied in connection with menstruation.

CHAPTER III.

THE GENITAL TRACT IN RELATION TO MICRO-ORGANISMS.

In recent years an immense amount of work has been done in investigating the life-history of germs in the genital tract, and the part that micro-organisms play in pelvic disease whether they enter through the vagina or by some other route.

THE BACTERIOLOGY OF THE GENITAL TRACT IN VARIOUS CONDITIONS.

In the new-born child, in almost all cases, no germs are found in the vagina. Very soon, however, they enter, favored by baths, washing, the application of oils, etc. Stroganoff states that a breech delivery of a female child favors their premature entry. Within the first two weeks gelatin-liquefying germs are rarely found.

In girls and women the vulva is the seat of many forms of micro-organisms, pyogenic and otherwise. They are most numerous after the growth of the vulvar hairs, especially in those of dirty habits. There has been much difference of opinion as to the normal condition as regards the healthy uncontaminated vagina, in both the nonpregnant and the pregnant woman, but the causes of these differences have been recently fairly well elucidated, and at the present time it may be accepted as proved that the genital canal tends to be maintained in a state of asepticity by natural means. Gönner first definitely stated this in 1887. He examined thirty-one women, and found no pathogenic organisms in the vagina, but only various germs which would not grow on the ordinary culture-media. He, therefore, maintained that prophylactic vaginal douches were not necessary, and that autoinfection of a woman could not occur. Döderlein, in the same year, made a series of examinations and announced that pathogenic organisms were frequently present, from which cultures could be obtained, and he opposed Gönner, urging the use of prophylactic douches.

Winter, in 1886, Staffeck, Burgubum and Witte, in 1890, came to conclusions somewhat similar to those of Döderlein. This worker, in 1892, made a further series of examinations in 195 pregnant women, and stated that he found two distinct types of secretion. One of these, termed normal, was a white, thickish, crumbly material, acid in reaction (probably due to lactic acid), containing epithelial cells, occasional yeast-cells, and many thick bacilli. The other secretion, termed abnormal, was more fluid and pus-like, less acid in reaction, often being neutral or alkaline, containing many leukocytes, epithelial cells, and all varieties of bacteria, especially cocci and short bacilli. Cultures from the normal secretion were almost always sterile. Those from the abnormal secretion showed positive results, various pathogenic organisms being found—streptococci in 10 per cent. of cases. He obtained the normal secretion in 55.3 per cent. of his cases, and the abnormal in 44.6 per cent. As a result of his work he modified his original view, stating that in those women with the

abnormal secretion autoinfection might occur, and that in them prophylactic douches should be employed.

Whitridge Williams, in 1893, examined fifteen cases, and found Döderlein's normal secretion in five and the abnormal secretion in ten. Cultures of pathogenic organisms were obtained, streptococci being found in 20 per cent. of all cases.

Krönig, in 1894, studied 100 cases, examining the vaginal secretion of pregnant women in all conditions, normal and pathologic, and did not find septic organisms, nor any which would grow aërobically on ordinary media at body-temperature, save in a few instances gonococci and yeast organisms. He, therefore, expressed the view that the vagina of every pregnant woman not recently contaminated by digital or instrumental examination or coitus is aseptic. In 221 cases he found Döderlein's normal secretion in 117; the abnormal in 104. Of the former, 30.8 per cent. had an abnormal puerperal history, and 29.8 per cent. of the latter.

In 1894 Döderlein challenged the soundness of Krönig's views. Krönig thereupon carried out a series of interesting experiments on pregnant women to determine the bactericidal action of the vaginal secretion. Cultures of the *Bacillus pyocyaneus* were introduced into the vagina. They were destroyed in all cases after a number of hours, varying in different instances, the average being twenty hours. They were destroyed most rapidly where the vaginal secretion contained cultures of Döderlein's long vaginal nonpathogenic bacilli; less rapidly in those containing short rods and cocci. All pathogenic staphylococci introduced were destroyed within twenty hours; streptococci within six hours. He concluded that the vagina becomes aseptic at most within two or three days after foreign material is introduced into it. He also stated that antiseptic douches weakened or destroyed the natural antiseptic action of the secretion. It is important to note that the gonococcus is very resistant to the germicidal influence of the vaginal secretion. This is also the case with the *Bacillus aërogenes capsulatus*, which is sometimes the cause of the abnormal vaginal secretion.

Menge, in 1894, confirmed Krönig's views showing that the natural antiseptic action exists in the nonpregnant state, though not so strongly as in pregnancy. In 1897 Krönig, having investigated an additional large number of cases, emphasized his previous statements. He maintained that the work of those who had found pathogenic organisms in the vagina had been faulty; that these organisms had been introduced from the vulva as the result of careless technic. His own method was so devised as to make contamination impossible.

Whitridge Williams, in 1898, made a new series of observations based upon Krönig's method of examination, and as a result corroborated the views expressed by Krönig and Menge, reversing his earlier opinions, which had been based upon faulty technic. He showed that the ordinary methods employed in obtaining the vaginal secretion are likely to introduce organisms from the vulva, which is rich in pathogenic and other microbes. His conclusion was that there is nothing to indicate that the vaginal secretion, whether of the normal or abnormal nature described by Döderlein, contains pyogenic cocci which can cause puerperal infection. As regards saprophytes, our knowledge is comparatively scanty. Gönner states that there are none in the vaginal secretion,

either aërobic or anaërobic. It is not impossible that some of the nonpathogenic germs which ordinarily exist in the vagina may occasionally act as saprophytes, but there is no proof of this as yet.

In view of the above-mentioned results, it is evident that in the great majority of cases prophylactic douching in pregnancy is unnecessary. Neither is it necessary after labor if the woman be not exposed to contamination by those who attend her during parturition.

Menge describes the following factors arranged in the order of their importance as contributing to the germicidal action of the vagina:

(1) The antagonism between the normal vaginal bacilli and those which were introduced; (2) the products of the vaginal bacilli; (3) the acidity of the secretion; (4) the secretion of the vaginal wall; (5) leukocytosis; (6) the absence of free oxygen in the vagina.

He found these properties in the new-born child where no vaginal bacilli exist. He also found that if two similar specimens of acid vaginal secretion be taken, and one be sterilized by heat, this specimen loses its germicidal power. If to the other specimen an alkali be added, the germicidal power is diminished, but not destroyed; if this sample be sterilized by heat, it is lost entirely and then becomes a good nutritive nidus.

It is, therefore, important to note that the vaginal secretion may vary greatly in its effects on microbes lying in it. While it may soon destroy them in many cases, in others it may only weaken them and destroy their virulence, as Winter and others have shown. This virulence may be regained if the nature of the secretion be altered, *e. g.*, by the action of gonorrheal infection, the presence of organic débris, etc.

As regards the influence of menstruation, Jacob and others state that the vaginal micro-organisms are increased during the period, owing to the diminution in the acidity of the normal vaginal contents as a result of the entrance of the blood.

Stroganoff states that they increase just before and after menstruation.

In old women he found various microbes in the vagina, mostly rod-shaped, and smaller, as a rule, than in the adult years, the vaginal secretion being faintly acid, except near the cervix, where it may be neutral or alkaline.

With regard to the uterine cavity, in normal conditions, practically all observers agree that it contains no micro-organisms. The vaginal organisms are, however, usually found in the region of the os externum. Gönner endeavored to make cultures of those found in pregnant women, but failed.

Menge stated, in 1893, that he always found the cervical canal free from germs except in cases of gonococcus-infection. The secretion of the canal was always alkaline. Stroganoff, after cleansing the os externum during menstruation, always found the canal free of germs. In old women he found them in 50 per cent. of cases. In cases of prolapsus uteri they were always present. He believes that the normal cervical secretion has some germicidal influence. Many investigations show that the gonococcus is able to advance above the level of the os externum.

With regard to the Fallopian tubes in health, there can be no doubt that they are free from micro-organisms.

In abortions, the vaginal reaction varies according to the amount of blood and débris found in the vagina. The germs also vary greatly in number and

nature from time to time; the pathogenic organisms are more apt to be found in the vagina and cervix in connection with abortions than in any other conditions, probably mostly due to digital examinations and manipulations.

Micro-organisms in the Female Urethra.—Gawronsky made cultures from the secretions in the urethra in sixty-two cases. In fifteen of these bacteria were found; in three the *Streptococcus pyogenes*, in eight the *Staphylococcus pyogenes aureus*, in one the *Staphylococcus pyogenes albus*, in two the *Bacillus coli communis*. Among the negative cases were ten in which the women had perimetritis or parametritis; six in which there was prolapse; three in which there was pregnancy.

RELATION OF MICRO-ORGANISMS TO PELVIC DISEASE.

At the present time the tendency is to attribute the great majority of pelvic inflammations to the action of micro-organisms. The inflammatory processes are simply, to state the modern view, the series of phenomena caused by nature's resistance to the noxious influence of the infecting organisms. These processes are, therefore, not evil in themselves, but are beneficial and purposeful. The most important germs which have been demonstrated to act as infecting agents are the following:

Streptococcus pyogenes.
Staphylococcus pyogenes aureus.
Bacillus coli communis.
 Gonococcus or *Micrococcus gonorrhææ.*
 Tubercle bacillus.

The following are less often a source of trouble:

Staphylococcus pyogenes albus.
Staphylococcus pyogenes citreus.
Staphylococcus epidermidis albus.
Bacillus ærogenes capsulatus.
Diplococcus pneumonia.
Bacillus pyocyaneus.
Streptothrix actinomyces or *Actinomyces bovis.*

These germs may gain entrance by the vagina, rectum, bladder, intestine, or may be carried from some distant part by the circulation. Infection may be caused either by one variety or by mixed varieties of organisms. The conditions which favor their entrance are a favorable soil, *e. g.*, a raw surface, a tissue of impaired vitality, a general condition of poor health in which the resistance of the tissues is below par, dying organic matter, *e. g.*, the remains of placenta or membranes *in utero*, or blood-clot that has been formed for a little time.

In some cases the micro-organisms are capable of attacking the tissues when the latter are in a state of perfect health, *e. g.*, gonococcus.

The most common source of entrance for the various germs is undoubtedly the vagina. They may spread up into the uterus and along the tubes, reaching the peritoneum, either setting up infective processes along the whole wall, or developing in some suitable discharge or débris which occupies the canal; or

they may enter a raw, injured, or diseased surface, and spread to cellular tissue, peritoneum, tubes, or ovaries by means of veins and lymphatics.

The part played by germs which find entrance by way of the rectum and intestine is not yet well known. In all probability it is greater than has been recognized. The frequency of retro-uterine inflammation in women, especially in the unmarried, is in my opinion not related so much to infection from the uterus as from the rectum. Experiments (I shall describe some of these on p. 259) clearly show how quickly the *Bacillus coli communis* can penetrate the bowel-wall and adjacent tissues, if they be at all impaired in vitality.

In the rectum the overstretching of the wall from constipation, so common in women, the continual soaking of the wall in this state with toxic matters being absorbed from the lumen, the occasional occurrence of cracks and ulcers, are all factors which favor the passage of organisms into the uterosacral ligaments, the surrounding cellular tissue and peritoneum, and even the uterus. Higher up in the intestinal tract, overloading of the bowel, pressure on it, and ulceration may also favor the migration of micro-organisms.

The bladder is probably an infrequent source of entrance. Where it has become infected on its mucous surface, and where the vitality of the wall is impaired, *e. g.*, by ulceration, pressure, or tumor growth, germs may pass from it to surrounding tissues.

The exact relationship between germ-action and various other factors which have long been regarded as causal in the production of pelvic inflammations has not yet been definitely established. I shall consider these in connection with the various diseases themselves.

Thus, menstruation has always been considered important in relation to the causation of inflammation, especially in the uterus, a chill or extra exertion being considered as playing a leading rôle. Now we are inclined to think that menstruation as a factor acts probably more by altering the nature of the vaginal secretion, rendering it more suitable for the growth of the pathogenic germs which might be lying in it, and thus making it more easy for them to extend upward into the uterus. No doubt other influences, *e. g.*, chill, fatigue, etc., might also favor their activity, by interfering with the normal resisting powers of the tissues.

Excessive coitus, especially at menstruation, is said to lead to inflammation, *e. g.*, in the uterus. There is no proof that the mere physical excitement can bring about this change. More likely it is associated with microbial activity, the irritation of the tissues caused by the excessive physical exercise favoring their activity. In many of these cases, undoubtedly, there is a gonorrheal infection at the time of coitus. The influence of labor has long been regarded as a prominent factor. In the puerperium all the conditions favorable to germ-activity are present. The woman is reduced in strength. The uterus is weakened by its great activity in delivery, the condition of its circulation is greatly altered, owing to the contraction and retraction of its musculature, and its tissues are below their normal standard of strength, owing to the puerperal retrogressive changes which take place in them. The inner surface affords a large absorbing area; the placental area presents a number of opened blood-sinuses in which blood-clots are formed; blood-clot often lies in the cavity; the cervix is often torn; the perineum and vagina may be bruised and lacerated; portions of the placenta or membranes may be left *in utero*.

That the lacerations *per se* can start an inflammation is not now believed. Were it not for germ-infection, they would heal by direct union or direct granulation, without the development of inflammatory phenomena.

There are certain conditions in the puerperium which may also predispose to infection of the uterus, *e. g.*, too early rising, walking, or working, but whether these conditions in themselves can lead to actual metritis is doubtful. One thing is certain, namely, that in many cases these conditions are followed by no disturbance whatever. It is common to find among the laboring classes those who systematically rise early after childbirth and go to work, in whom no inflammatory changes whatever follow.

Injuries resulting from operative measures may, by bruising, lacerating, or cutting the wall of the genital tract, afford a nidus for the development of germs; the irritation of a pessary may act in the same manner.

The influence of certain general conditions, *e. g.*, rheumatism, malaria, scrofula, constitutional syphilis, probably plays some part in certain pelvic inflammations, but we cannot at present speak with any definiteness in regard to how they act nor in regard to their relationship to microbial action. They may certainly act in one way, namely, by depressing the vitality of the tissues.

Regarding the modes of action of the various germs, it is needless to speak. Various tissues are affected; various results produced, these variations depending upon the mode of entrance of the microbes, their virulence, the nature of the soil on which they grow, the power of resistance of the tissues.

Gonorrhea.—Special reference must be made to the part played by the gonococcus discovered by Neisser in 1879.

Since Noeggerath published his first paper in 1872, great attention has been given to the study of gonorrhea as a factor in the production of pelvic disease in women. In Great Britain Sinclair, and in Germany Sanger, have been especially prominent in pointing out its importance.

A woman may acquire an acute gonorrhea. In such a case the gonococcus develops by selection in the mucous glands of the urethra and urethral orifice, in the ducts of the Bartholinian glands, and often in the mucosa of the cervical canal. So far as is known, the vaginal wall is probably proof against the activity of this germ, unless its vitality be impaired, or its epithelium thinned, bruised, or cracked. Thus it may be attacked in young children, old women, or after labor.

In most cases the acute disease is set up in the cervix and vulva at the same time. Sometimes, however, as a result of the contaminating coitus, the cervix may be at first affected, and the vulvar region afterward. In some cases only the external parts are infected. In any case, it is of great importance to note that when all acute symptoms and signs have passed away, the disease may still be present in the crypts about the urethral orifice, in the ducts of the Bartholinian glands, and in the cervix.

In connection with gonorrheal infection, sometimes in the acute stages, but more commonly after the acute stage has passed away, inflammation may spread up the whole mucosa of the uterus, and may extend to the tube, ovary, or peritoneum. It may spread to the bladder, ureters, and kidney. It may affect the Bartholinian glands. It may be carried to distant parts, *e. g.*, joints, endocardium, and pleura, and set up pathologic processes. It may cause abscesses in the cellular tissue.

The gonococcus may act alone or it may frequently be associated with other organisms. Thus it has been noted that in the later stages of gonorrhea *Staphylococcus pyogenes aureus* is frequently found as an additional cause of chronic infection, the activity of the latter organism appearing to be favored by the influence of the gonococcus. Frequently in such cases the virulence of the gonococcus may be greatly diminished, and the organism itself may disappear. The presence of gonococci usually causes increased secretion from the tissues, with marked emigration of leukocytes, which act as phagocytes taking up the organisms. Their destruction is, however, only slowly brought about, and when once they have thoroughly invaded the tissues, they are very slowly destroyed. Indeed, after all active manifestations have disappeared, small foci may remain both in the male and in the female (latent gonorrhea), and by various exciting causes their activity may be renewed years after the primary infection.

De Christmas has made some interesting observations regarding the toxic products of the gonococcus. He cultivated the organism in a mixture of ascitic fluid and bouillon. In twelve days the germs had perished, though the fluid had toxic properties, which he believed to be derived from the broken-down organisms. If the toxic substances along with the proteids are precipitated by means of alcohol and the precipitate be desiccated, it is found to possess a toxic action; when it is injected into the anterior chamber of a rabbit's eye, it causes suppuration. If it be injected into the urethra of animals, it has no effect, but if introduced into the human urethra, it causes acute catarrh, with purulent discharge.

Regarding the spread of an inflammation from the urethra to the bladder, and, it may be, up the ureter to the kidney, it is believed that the infecting agents are colon bacilli, pyogenic cocci, and not the gonococcus, the former acting in the favoring conditions produced by the action of the latter in the urethra, their virulence often being intensified.

As regards the setting up of inflammation in the Bartholinian glands, the gonococcus alone may be directly responsible, or it may be associated with various other infecting organisms. The gonococcus might be expected to attack the gland, because its acini are lined with a single layer of cylindric epithelium, a tissue easily invaded by the organism.

As regards the uterus, there seems little doubt that inflammation may be set up both in the mucosa and in the whole wall by the gonococcus. As to the frequency with which this occurs, one cannot speak with accuracy. Schultze has clearly shown that it is not always invaded in an attack of acute gonorrhea.

Wertheim claims that the organism may invade the subepithelial tissues, while Bumm holds that it grows only on the surface.

In many cases of uterine inflammation, which clinically might be attributed to the influence of the gonococcus, the germ cannot be found at all. No doubt, in some of these cases, the infecting agent is some other organism, *e. g.*, staphylococcus, streptococcus.

The gonococcus is not always easily found. Van Schaick has demonstrated that repeated examinations may sometimes lead to its detection when a single search may prove negative. Probably in many chronic cases the germs may be few and far between, and the chronic irritation in the tissues may be kept up by the toxins produced by the gonococci. When other organisms are present, a few gonococci distributed among them may easily be missed on microscopic examination. Dead or perishing organisms may fail to react

to the staining methods. With regard to stains, it may be noted that while Gram's method is widely employed, various workers in recent times have used the methylene-blue and pure tannin method of Nicolle when the former has failed to detect the gonococcus. Cultures alone afford a certain test.

As regards the tube, there is ample proof that the gonococcus may infect it and lead to inflammation. The majority of cases of salpingitis are due to this cause. The infection usually spreads from the uterine mucosa. A. Martin and others believe that in some cases it may reach the tubes by way of the lymph-channels or spaces in the connective tissue of the parametrium. Mixed infection may occur in some cases. The infection very frequently leads to purulent distention of the tubes. In many chronic cases the gonococci cannot be found in the pus because they have perished.

As regards the peritoneum, it is held by many that the gonococcus is capable only of setting up localized pelvic inflammation, *e. g.*, perisalpingitis, periovaritis, and not a general peritonitis. The gonococcus does not ordinarily appear to survive long in the peritoneal cavity; if the latter occurs in connection with gonorrheal infection, it is believed to be due to some associated organism, *e. g.*, streptococcus. It appears certain that occasionally general peritonitis may be caused by the gonococcus alone. This was first demonstrated by Frank, of Louisville, in 1895. It is also believed by many that cellulitis following gonorrheal infection is not due to the gonococcus directly, but to associated organisms. As regards the ovary, it is also believed that the gonococcus may infect it from the tube and set up inflammation.

The marked liability of pregnant and puerperal women to acute gonorrheal infection must be noted; and also the tendency to development in these states of an acute exacerbation of what was previously a slight infective inflammatory process. Thus a latent condition may develop into an acute outbreak in pregnancy or in the puerperium without any fresh infection from without.

Sänger has pointed out that in the puerperium a special variety of acute inflammation of the tubes and ovaries of a pure gonorrheal nature may be due simply to a recrudescence of an old gonorrheal trouble.

It must, however, be remembered that similar phenomena may be produced by the action of septic organisms. These always find more favorable conditions for development where there has been a latent gonorrhea. Possibly, therefore, some of the cases referred to by Sänger are of this nature.

The particular work of Noeggerath was to point out the importance of "latent gonorrhea in the male" as a factor in the production of various diseases in the female pelvis, especially endometritis, salpingitis, ovaritis, and localized peritonitis. He pointed out, what is now generally recognized, that the male urethra may remain the seat of a latent infection long after all apparent signs and symptoms of acute gonorrhea have passed away. This power resides in a discharge produced by the remains of the original gonorrheal infection, and is probably usually limited to the crypts of the mucous membrane.

The excitement of marriage, of alcoholic indulgence, or of overfatigue may stimulate these areas of latency into renewed activity, and, as a result, the woman, after coitus, may be infected in the manner which I have described. Very often a perfectly healthy woman is infected this way at the time of her marriage, developing various forms of pelvic trouble soon afterward.

Colon-infection.—The *Bacillus coli communis* is especially found in inflammatory and suppurative processes connected with the alimentary canal. In relation to general peritonitis it is considered elsewhere.

It is probable that some chronic inflammatory conditions in the pelvis, especially in the posterior portion, are caused by this organism passing through the bowel-wall, whose vitality is altered in various ways, *e. g.*, chronic constipation, adhesion or pressure of masses in the pelvis, ulceration, catarrhal condition of the mucosa.

In other cases invasion may occur by way of the genital tract, the organism being alone or mixed with other germs. It is very frequently found as a cause of infection in the bladder, ureters, and kidneys, alone or associated with other organisms. Occasionally the colon bacillus may infect distant tissues, *e. g.*, pleura, endocardium, etc.

Tuberculosis.—Genital tuberculosis is much more frequent in the female than in the male; according to Merletti, in the proportion of twelve to two.

From a study of the records of 798 autopsies in the Brompton Consumption Hospital in London, Berkeley states that the genital organs were affected in 62 cases as follows:

Fallopian tubes.....	80.6	per cent.
Body of uterus	20.0	" "
Ovaries.....	22.5	" "
Cervix.....	6.4	" "
Vagina	6.4	" "
Vulva	0.0	" "

In only one instance was the genital tuberculosis primary. Infection may be introduced in a variety of ways:

1. It may be primary, *i. e.*, the bacilli may enter from the outside by way of the vagina, being introduced by dirty instruments, by examining fingers, by sleeping with a tuberculous person, by coitus with a man suffering from genito-urinary tuberculosis. In such cases the vagina and cervix may be first affected, the disease spreading afterward along the uterine and tubal mucosa; or the upper genital tract may sometimes be first attacked, according to Whitridge Williams, the bacilli entering a denuded surface on the vaginal wall and being carried up by the lymphatics.

It is extremely likely that primary invasion very rarely occurs from without in this way. Indeed, Amann considers it questionable if it ever takes place. Evidence gained from operations is not conclusive proof of primary infection. In the case of marriage with a tuberculous man, Amann holds that there is more chance of infection through the respiratory tract than through the genital tract.

2. The genital organs may become affected by the direct spread from neighboring tuberculous areas, *e. g.*, tuberculosis of bladder or bowel; ulcers may perforate or abscesses burst, leading to fistulous communications.

One of the most frequent sources of genital tuberculosis is tuberculous peritonitis. Weigert has shown that in this disease the bacilli which become free in the peritoneal cavity tend to sink into the pelvis, setting up infection; they are there in the best position to be swept toward and into the tubes, and they may be undoubtedly carried into the latter, setting up disease, without infecting the pouch of Douglas at all.

3. The bacilli may be introduced directly into the vagina when the patient has tuberculosis in some other region, *e. g.*, urinary tract, intestines, lungs, the infection spreading from the discharges.

4. It is also believed that the bacilli may sometimes be carried in the circulation from some affected area to the genital tract.

The most common seat of primary infection in the adult is the respiratory tract, less frequently the bronchial glands, the intestine, and mesenteric glands. In young children the primary seat is generally the lymph-glands.

Hegar has pointed out that genital tuberculosis is rare in childhood and after the climacteric. Still, in 126 consecutive autopsies in females under twelve years of age, found genital tuberculosis in 12 cases (9.5 per cent.). In 13 cases there was general tuberculous peritonitis. In no case was the vagina or vulva affected, and only in one the ovary. Merletti places the percentage at 7.3 per cent., and Berkeley states that the Brompton records place it at 6.8 per cent. It is probable that in the great majority of cases the bacilli do not enter by way of the vagina, for tuberculous peritonitis is found as often, if not oftener, in boys than in girls.

Berkeley states that the Brompton records show that 93.2 per cent. of the cases of genital tuberculosis occurred in the child-bearing period. It is believed that inflammatory conditions of the genitalia increase the liability to tuberculous infection.

Infection by men suffering from genito-urinary tuberculosis is of considerable interest. A good many cases have been noted in which tuberculous epididymitis has given rise to infection. There are instances also in which men suffering from pulmonary tuberculosis have infected the genitals of their wives, but it is not known whether, in such cases, the tubercle bacilli are contained in the semen.

Landouzy and Martin mixed the semen of a guinea-pig which had died of tuberculosis with salt solution and injected the mixture into the peritoneal cavity of fifteen guinea-pigs; five died of tuberculosis. Curt Jani found very few bacilli in apparently healthy testicles and prostates of persons with tuberculous phthisis. Gärtner states, in reference to Jani's description, that in tuberculous patients, before death occurs, the bacilli may spread to various parts of the body, and hence in this stage may often be found in the blood.

Spano injected semen from a tuberculous man into the abdominal cavity of eight guinea-pigs and produced tuberculosis in six cases. In two other cases, by injecting it into the vagina, genital tuberculosis was caused. Mafucci injected large doses of bacilli into the jugular vein of a dog, and found them afterward in the semen of the animal.

Rohlf, however, introduced semen from a tuberculous man into the anterior chamber of the eyes of goats and rabbits by means of a needle puncture, and got no results. The amount of virus introduced was, however, very small in these cases, and goats are not very susceptible to tuberculosis, so that these experiments are inconclusive.

Westermayer introduced testicular tissue from a tuberculous patient into the peritoneal cavity of rabbits without setting up tuberculosis, but he was not able to distinguish tubercle bacilli on microscopic examination of the testicles. In a case of acute miliary tuberculosis, in which bacilli were found in the testicle, injections of portions of it into the peritoneal cavity caused tuberculosis

in the rabbit. Walther examined several testicles in cases of phthisis and found no tubercle bacilli in them. Gärtner thinks that they are very scanty in the semen in such cases. He injected tubercle bacilli in the trachea and lungs of male guinea-pigs, setting up infection, and after three or four days obtained semen from their testicles. In thirty-two cases he found tubercle bacilli only in five, and the semen in these few instances, when introduced into the peritoneum of other animals, set up only a mild form of tuberculosis. In another set of cases he set up tuberculosis in the testicle by local infection, and found that in 50 per cent. of the animals into which he introduced the semen severe tuberculosis was set up. Gärtner, therefore, believes that genital tuberculosis in the male is a very much more serious danger for the female than distant tuberculosis.

The various parts of the genital tract, including the ovaries, may be affected, though the vulva and vagina are very rarely attacked. Sometimes a mixed gonorrheal and tuberculous infection may take place. Pyosalpinx may develop in tuberculous salpingitis, probably associated with a mixed septic infection.

Infection with Streptococci and Staphylococci.—The rôle played by these organisms in septic infection is so well known that a detailed account need not be given here.

The *Streptococcus pyogenes* is found in various infective conditions in the pelvis, especially in connection with abortions, labors, and dirty operative procedures. It may act alone or in association with other organisms. It is the most important cause of general septicemia.

Infection with Bacillus Aërogenes Capsulatus.—This organism, described originally by Welch and Nuttall, is an anaërobe. It is probably a constant inhabitant of the intestines. It generates gas in connection with its growth, and especially tends to invade dead or dying tissue. It may be associated with other infecting organisms. In abortion or labor cases it is sometimes the cause of infection. It is found in emphysematous gangrene, vaginitis with gas cysts, physometra, and in various suppurative processes associated with gas formation.

Actinomycosis of the genital tract is very rare.

CHAPTER IV.

NEUROSES IN RELATION TO PELVIC DISEASES IN WOMAN.

The disturbances termed "neuroses" occur in many variations and degrees, and they are variously related to pelvic and abdominal disorders. The gynecologist must devote the most careful attention to their consideration in order that he may give to them proper proportional values. For several years the term "neurasthenia" has been employed to describe various neuropathic disturbances found in women, but latterly there has been some tendency to discard this term as one which is vague and capable of application to a series of phenomena differing very considerably from one another. Other expressions used as synonymous with it, *e. g.*, "nervous exhaustion," "nervosism," "spinal irritation," have to a considerable extent passed out of use.

The neurasthenic state, no matter what its manifestations may be, is one in which there is a lowering of tone in the nervous system. According to Arndt, though there is a deficiency of nerve power, there is an increase in energizing, due to a weakness in inhibitory power and to the too ready response of the nervous system to stimuli. In the worst stages of the condition the increased excitability has changed to a state in which there is a blunting of the nerve sensibility.

Hyperesthesia and motor weakness, then, are the chief features of neurasthenia. Abnormal sensations and pains may be felt in different parts of the body. Cramps and twitchings may develop. The pupils may be unequal in size; the tendon-reflexes are often exaggerated; there is often a feeling of languor and of unfitness for work. The appetite fails; pains in the stomach and bowels may develop, along with indigestion, constipation, etc. Emaciation is common, though in some cases fat is increased, the patient appearing pale and unhealthy, however. The urine is often of low specific gravity, may contain deficient urea, and often abundant phosphates. Sleeplessness may be marked. The woman may become very anxious and be subject to anxiety or fears; various other abnormal emotional and mental symptoms may gradually become established, and in extreme cases some form of insanity may arise.

Neurasthenia may lead to hysteria, and may present symptoms which are found in hysteria, but it is important to keep in mind the great difference between the conditions. As Allbutt puts it, neurasthenia is the state in which there is "defect of endurance"; hysteria that in which there is "defect of the higher gifts and dominion of mind." "The neurotic woman is sensitive, zealous, managing, self-forgetful, wearing herself out for others; the hysteric, whether languid or impulsive, is purposeless, introspective, and selfish."

HYSTERIA.

Hysteria is a condition in which especially the higher nervous centers are at fault. Charcot calls it a psychic disease. According to Havelock Ellis,

the general character of the mental phenomena in hysteria may be summed up in the word suggestibility. There is an abnormal degree of response to suggestion in the nervous system, especially in reference to physical conditions. There is a partial or complete loss of inhibition in regard to voluntary actions, and also a disturbance of the nervous centers regulating the automatic movements. The weakness of inhibition is associated with the tendency to erratic and extravagant reactions to stimuli—the state which has led Féré to give to the hysteric the name “frog of psychology.” Then there is the tendency for many or varied nervous phenomena to spread from a small area of excitation. The powers of the higher centers may greatly alter in regard to the initiation of movements; sensory perception may be partially or entirely wanting.

Bastian sums up the symptoms under the following heads:

1. *Mental*.—Judgment, accuracy, and power of concentration are weakened. The emotions are easily excited and badly controlled. There is a morbid desire for the sympathy of others; she craves attention continually, is full of caprices, and makes excessive demands on those about her.

As Oliver Wendell Holmes says, “She is a vampire who sucks the blood of the healthy people about her.” If she is checked or chided in any way, she takes offense, gets irritated, bursts into tears, or has an attack of pain, paralysis, or some other manifestation of the hysteric condition.

There is often a tendency to tell untruths and to practise deceptions. Clouston has pointed out particularly the changes due to the loss of inhibitory influence on the reproductive and sexual instincts. There may be various perversions of sexual emotions, *e. g.*, abnormal yearning for love. Formerly these alterations were exaggerated; now, possibly, too little attention is paid to them. When these cases become extreme and hysteric insanity is developed, the prominence of sexual and erotic ideas is marked; there is often mock modesty; often a tendency to describe the pelvic condition with great detail; in some cases they have visions in which coitus plays a prominent part; sometimes they imagine they give birth to various animals. Lombroso has pointed out that criminal acts performed by the hysteric are very often connected with sexuality.

2. *Sensory*.—Pains, hyperesthesia, and anesthesia are found. Pain is apt to cease suddenly when the attention of the patient is taken from her condition. Common seats of pain are the lower part of the chest, especially on the left side; the region of the spine, of the vertebræ, especially the upper ones; joints, especially if there has been a slight injury; the mammæ; the skull; the epigastric and iliac regions. Pressure over painful areas may cause marked changes, *e. g.*, disturbances of respiration and circulation, great increase in the pain, hysteric convulsions, etc. In some cases, by pressure over the ovaries, marked hystero-epilepsy may be caused. Anesthesia may exist over the whole surface; more often it is one-sided, especially left. It may be confined to a small area or may be irregularly distributed. The special senses may be disordered, *e. g.*, there may be intolerance of light, loss of vision, smell, taste, hearing, etc., numbness, coldness, prickings, etc.

3. *Motor*.—There may be various local spasms, general convulsions, paralysis. Globus hystericus is the condition in which the patient feels a lump pass from the epigastrium to the throat, choking her and often causing her to cry.

Cough is a common symptom when the patient is observed; it is absent when she is alone. Sometimes it is accompanied with abundant discharge. In some cases inspiration may be jerky and spasmodic, accompanied with a choking sensation; in other cases expiration is of the nature of a wheeze, a whistle, a dog-bark, or it may be like laughing or crying. Yawning, hiccup, and sneezing may be met. Clonic spasms may occur in different parts, *e. g.*, neck, back, thigh. Tonic spasm is more frequent; contracture of limbs may thus be caused and may continue for years, lasting during sleep and anesthesia. If this takes place in the abdominal muscles, a tumor may be simulated.

Convulsions are common and may be preceded by various symptoms, *e. g.*, pain, giddiness, choking, shrieking. When the patient falls in one of these attacks, she doesn't usually hurt herself or fall in the fire. There is often more or less opisthotonos. Consciousness is often retained, but it may be partly or wholly in abeyance. Self-infliction of injury is absent, and the tongue is rarely bitten. These attacks may be single or multiple and successive. Paralysis may be found. Paraplegia is common; hemiplegia less frequent. There may be incapacity for speech or aphonia; sometimes the tongue or neck cannot be moved.

4. *Circulatory*.—Syncope may be developed and may sometimes be very marked, the pulse becoming feeble and the patient prostrated. In some cases irregular and bounding cardiac action is present. The aorta may pulsate strongly. There may be abnormal capillary action, *e. g.*, hyperemia, ischemia.

5. *Visceral*.—Vomiting is common. Disturbed digestion, flatulence, constipation, diarrhea may be found. Distention of the bowels may occur, forming phantom tumors. There may be retention of the urine, dysuria, or frequency of micturition; sometimes suppression of urine. Pains occur in the region of the kidneys, ovaries, uterus, coccyx, etc. Dysmenorrhea and other abnormalities of menstruation are common.

Sequelæ.—It is important to remember that hysteria may pass into mental disease, *e. g.*, mania, melancholia, dementia.

Relation of Pelvic Disease to Insanity.—This relationship is not definitely established. Insane women undoubtedly have pelvic disease just as sane women have, but whether there is any connection between them of the nature of cause and effect it is impossible to say. It has been proposed by some to remove the appendages in cases where abnormal sexual aberrations are part of the insane manifestations, but there is no rational ground for such a procedure.

Rohé states that 60 per cent. of women in the Maryland Asylum have pelvic disease or developmental defects, the latter being often found among "degenerates." He thinks that these lesions should be treated just as they would be in sane women. He gives an account of 34 cases on whom operations were performed, 30 being abdominal sections for the removal of the appendages. In 3 of these a secondary vaginal hysterectomy was done, in 2 repair of a lacerated cervix, in 2 vaginal removal of uterus and appendages. Of the 30 abdominal sections, 10 were cured physically and mentally, 4 were decidedly improved, 13 were unimproved, 3 died. Of the 3 secondary vaginal hysterectomies, 1 was cured and 2 not improved. Of the 2 primary total extirpations, one was cured and the other improved. The 2 trachelorrhaphies both recovered, mentally and physically. The forms of insanity in which recovery took place were: puerperal mania, 4; melancholia, 6; mania, 3; hystero-epilepsy, 1.

Total, 14. Those in which complete recovery did not follow were: melancholia, 2; mania, 5; puerperal mania, 1; dementia (including 4 epilepsy), 7 (3 deaths); paranoia, 2; hysterical insanity, 2; adolescent insanity, 1. Total, 20. Rohé believes that early operation would increase the proportion of recoveries.

The operations of Rohé were performed solely for the purpose of influencing the mental conditions. His views have been strongly opposed by various alienists.

Leroy Broun has recently published the results of his observations on a large number of operative cases in New York, the surgical procedures having been carried out solely for the improvement of the physical condition. His conclusions are:

1. If the necessary operation is satisfactorily performed, and unnecessary castration is not carried out, the mental condition is never aggravated.
2. There exist among insane patients many pathologic conditions which can and do give rise to symptoms detrimental to the patient's physical well-being and mental recovery.
3. Under the stimulus of the improved somatic state resulting from surgical relief some of the patients show greater mental advancement under the moral and therapeutic care than were shown before relief was given. Sometimes this improved mental state continues to one of recovery.

NEURASTHENIA.

The investigation of neuroses in women must be conducted without prejudice and with the understanding that not one but various factors may be concerned in their production. In a comprehensive study recently made by Thomas Savill the following pathologic factors are described:

1. Toxic blood states, including the conditions arising from prolonged gastric disturbances and constipation.
2. Malnutrition of the nervous system arising in various debilitated conditions.
3. Overfunctioning or fatigue of the nervous system.
4. Emotional shock or strain and traumatism.

The predisposing influence of an inherited weakness must also be considered. In many cases of neurasthenia more than one of these pathologic conditions may be present, and Savill points out that any one of them may act as a predisposing cause really determined by one of the others.

That neuroses should be so common in women is not to be wondered at. Though Michelet's dogma is not true, that "woman's life is a history of disease," it must be admitted that it is one of physiologic unrest, except in youth and old age. When we remember the great disturbances which mark the advent and departure of the reproductive era of her life, the profound changes taking place during ovulation, menstruation, pregnancy, labor, and lactation; the subtle and complex activities of her physical life in its various diastaltic functions, it is not remarkable that neuroses should manifest themselves particularly in relation to her reproductive mechanism. That they are increasing *pari passu* with the advance in our higher civilization cannot be denied; among the poor, the inducing factors being overwork, overworry, ill-regulated

and poor nutrition; among the well-to-do, educational strain, overindulgence, the stress of modern life, emotional excitement.

In the analysis of cases it is, therefore, necessary to give careful consideration to the habits, environment, and heredity of patients, but it is also of the highest importance to make a thorough examination of all the symptoms of the body. In a very large percentage of cases definite physical changes in the abdominal or pelvic viscera or in both will be found to be the most important factors in determining the neurasthenic phenomena.

Gynecologists have not been backward in assigning as important etiologic factors many lesions of the genitalia, and such marked prominence has been given to the latter by a narrow school of specialists that they have brought upon themselves the well-merited criticism of many physicians of eminence in different countries. On the other hand, it must be admitted that there has been a great tendency among physicians and neurologists, especially those who are fond of explaining neuroses in terms of "nerve exhaustion," "nerve strain," etc., to ignore the influence of local disorders in the female genitalia or in other regions of the body. They are largely responsible for the common practice of ordering rest-cures and trips to health-resorts without making a systematic examination of all the systems of the body. It is, indeed, probable that the errors in diagnosis and treatment made by neurologists of this type have been as marked as those made by the narrow school of gynecologists. In recent years very great attention has been given to the subject of visceroptosis, largely owing to the work of Glénard, published in 1885. To this condition this author attributed the chief share in the production of neurasthenia. While his views have undoubtedly been exaggerated, there can be no doubt that visceroptosis in its various forms often plays an important part in the neuroses of women, both from disturbances in the abdominal sympathetic system resulting from stretching of the attachments of the viscera, and by interference with the various functions of the alimentary tract.

A careful study of the abdominal viscera should always be made by the gynecologist, for in disturbances in this region may be frequently found the explanation of a woman's complaints rather than in some associated pelvic lesion. Yet it must also be clearly recognized that various pelvic lesions may alone be the starting-point of many distant disturbances related to physical, sensory, motor, circulatory, and visceral functions, though they very frequently may be associated with some of the other pathologic conditions which have been described as causal factors. The relationship between the pelvic disorder and the various neuroses, in cases in which the latter are dependent upon the former, is not at all accurately known. For many years it has been customary to explain the neuroses as developing reflexly. While, undoubtedly, such a nervous mechanism may explain some cases, it is not believed at the present time that it is the sole factor concerned. The internal genitals are mainly supplied by branches of the sympathetic system, which is widely related to the cerebro-spinal nervous system. Remak and other authorities have referred to the influences which may be brought to bear on the latter through the medium of the former, either directly or indirectly. In connection with the reflex theory it is well to mention such an occurrence as teething with its associated nervous and alimentary disorders.

Many authors believe that the neuroses are part of the phenomena asso-

ciated with nutritional disturbances. Others believe that in some cases actual changes are induced in nerves of the nature of neuritis. In conditions of visceroptosis where the functions of the alimentary canal are disturbed, it is highly probable that altered metabolism may to a large extent explain the nervous disturbances, though it is possible that, by the absorption of toxic material from the intestine, there is a poisoning of nerves resulting in definite changes. It is, of course, well known that marked neuritis may occur in septic processes caused by well-known micro-organisms.

In cases in which the ovaries are affected, it is generally believed that neuroses are induced reflexly, but there is a strong likelihood that the changes may also be due to the influence of an altered internal ovarian secretion, affecting tissue metabolism. It is highly probable that the nervous phenomena which characterize the climacteric are mainly due to the changes taking place in the function of the ovaries. Virchow long ago emphasized the importance of the normal genital (ovarian) function on general metabolism and nerve activity, both in normal and pathologic conditions.

In the study of pelvic symptoms in women it is also of great importance to bear in mind that they may be more or less influenced by neuropathic disturbances. Thus in considering pelvic pain the following points should be noted: 1. The pain may be directly due to distinct pelvic lesions, sufficient in themselves to produce this symptom. 2. Pain may exist with minor degrees of pelvic trouble insufficient in themselves to cause more than a small amount of suffering. 3. Pain may be a pelvic symptom in association with some condition which in itself cannot directly produce this symptom. 4. It may be a prominent symptom in cases in which no local changes of any kind can be made out.

It is, therefore, very evident that other than local factors must be taken into account as explanatory of the local subjective phenomena which we are considering. Of chief importance among these is the neuropathic state in the widest meaning of the word.

In one set of cases a local lesion, capable or not in itself of causing pain, may be the primary cause of development of a neurotic condition manifested by diverse phenomena. The more marked these become, the more is the pelvic pain intensified—reactionary exhibition of the neurosis, as it were—on the seat of the primary affection. In another class of cases there may be a slight pelvic lesion causing very little discomfort. A neurotic condition may be developed from causes foreign to the pelvis, and this may manifest itself in intense pain, referred by the patient to the pelvic lesion. In another set the symptom of pelvic pain is developed as one of the phenomena of a widespread neuropathic state, there being no local lesion of any kind.

There is another interesting class in which the local symptom is practically the only neurotic feature in the patient. In some of these cases the condition is somewhat like that in which the possession of a "fixed idea" is characteristic. In others it is of the nature of a "secondary reflex action," induced by a former continuity of habit, when there was an actual painful local lesion which has since been cured. The patient's nervous system has so registered the former habit that it is reproduced in opposition to the influence of the higher inhibitory centers. This power of impressing the nervous system is a well-recognized biologic truth. It is exemplified in the case of the gouty man whose

foot has been amputated, and who continues to have attacks of pain in the place where his toes should be as of old.

General Consideration as to Treatment.—In cases in which marked neuroses are associated with pelvic lesions, the most careful study must be made in order that the proper relationship between them may be established. Concentration of the attention on the pelvic disorder may lead to neglect in the determination of more important factors in producing the neuroses. In hysteric cases injudicious investigation on the part of the physician may be very injurious, especially if he is careless in his examination of the pelvis or in his remarks in reference to it. New suggestions may be created in the woman's mind or old ones may be strengthened. When the patient is an unmarried woman, it is always advisable to conduct the pelvic examination under anesthesia, and for this purpose nitrous oxid gas is very suitable in the great majority of cases. It is in cases of hysteria in which symptoms are referred to the pelvis that the gynecologist is most likely to be misled, both in diagnosis and in treatment, and he must even bear in mind that such symptoms may be present without a pelvic lesion sufficient to explain the condition.

In neurasthenia there is very often a direct relationship between pelvic disorders and the neuroses. In true hysteria, while there may sometimes be an associated pelvic disturbance, it is not necessarily antecedent or causal in the majority of cases. In carrying out treatment failure or only partial success may result because of the difficulty in ascertaining the various factors which cause the neuroses. The measures to be adopted should be systematic and thorough, and in most cases should extend over a period of months. Sometimes there may be a sudden or miraculous change in the condition of a hysteric patient, but in the case of neurasthenics recovery is usually gradual and protracted.

Whatever measures be adopted, the progress will be most satisfactory if the physician has the complete confidence of the patient and if he has the power of impressing her psychic organization, of encouraging her sympathetically, of teaching her to exercise patience and self-control, and of removing from her anxiety as to the gravity of her state. The general treatment need not here be described in detail, as it may be found in special works on nervous diseases. It embraces a wide range of measures, *e. g.*, change of scene and occupation, freedom from overwork and worry, improvement of nutrition, care of the alimentary tract, exercise, electricity, hypnotism (rarely). In marked cases isolation of the patient for several weeks under the care of skilled nurses may be necessary, regular massage being carried out, highly nourishing and easily digestible food being given, *e. g.*, milk, eggs, etc., and faradic electricity being applied to the muscles in some instances. This line of treatment is particularly valuable in hysteria. In neurasthenia isolation is not usually so essential; indeed, patients may become melancholy if left too much alone, and while removal from their ordinary occupations may be advisable, it is equally necessary to provide them with some cheerful society.

Operative treatment is necessary in many cases where there is a distinct remediable pelvic or abdominal lesion. But it must be insisted upon that these shall not be placed in the forefront of the therapeutic measures at our disposal, nor shall they be undertaken until the entire state of the patient has been investigated, and every effort made to improve her condition on the lines which I have laid down.

In many cases the pathologic condition is readily determined by physical examination. Special reference must, however, be made to those cases in which the ovaries may be markedly altered by chronic progressive small cystic degeneration or cirrhosis. These conditions may be associated with some of the most marked neuroses, though pelvic symptoms may be absent or only slight. If there be little enlargement or tenderness in the affected ovaries, the physician is very apt to overlook the condition entirely. Yet the careful gynecologist knows that the most extensive destruction of the ovaries may exist without any enlargement. In such cases it is probable that reflex nervous disturbances are caused by increased tension in the ovary, but it may be that there may be an alteration in the maternal secretion of the ovaries which may directly affect metabolism or the functions of the nervous system.

The author has frequently treated such cases after all the well-known general measures have been employed, and has found that ovarian resection or removal was followed by cure. In the majority of such cases the conservative procedure of removing the diseased portion of the ovary only may be employed, and even though there may afterward be a return of the degeneration in the remaining part, necessitating a second operation, it occurs in so small a percentage of cases that the chance may be taken, rather than that complete removal of the ovaries should be in the first place carried out. Operations for the removal of chronic infective conditions of the adnexa or new-growths, for the correction of uterine displacements or visceroptosis, are frequently followed by the most satisfactory results. In every case it is necessary to give a guarded prognosis as to rate of improvement to be expected after operation. Where the nervous disturbances have existed for a considerable time, a period of several months is usually necessary to insure recovery. Similarly, in operating for the relief of symptoms related to the pelvis, the cure will be hastened and more firmly established by careful attention to all other conditions which may possibly have helped to develop neuropathic complications.

CHAPTER V.

CASE-TAKING AND PHYSICAL EXAMINATION.

The examination of a woman suffering from one of the diseased conditions peculiar to her sex is sometimes a very simple matter, but very often it is a difficult and unsatisfactory process. A physician may investigate the state of her lungs or nervous system with comparative ease, but when the region of the pelvis enters into consideration, exceptional tact and skill are, in many cases, essential to the acquirement of all the information that may be desired. It is most important that the investigation should be conducted so that the patient is convinced that she is being treated with the utmost consideration and delicacy. No definite method can be adopted for all cases. It is necessary to vary the method of procedure according to the nature of the case, the temperament and condition of the woman, as well as other factors. There must always be a judicious blending of the *suaviter* and *fortiter*. A physician may possess great knowledge regarding the pathology and treatment of diseases of women, but he will not make great headway in the practice of gynecology unless he ever appreciates the subtleties and peculiarities of the psychic organization of women. Delicacy, tact, patience, and judgment must be brought into employment. Thoroughness, also, must be particularly enjoined. Owing to the peculiar difficulties of gynecologic examination, there is a constant temptation to be satisfied with an imperfect acquisition of facts, and there is no department of medicine in which more serious mistakes may ensue from want of thoroughness than in gynecology. Finally, downright honesty should be the motto of the physician. There is no sphere in which there has been more dishonest practice, and it is not out of place to utter a strong protest against the crime practised by those who, for the sake of gain, trade on the fears which naturally fill the minds of many women when their reproductive apparatus is out of order, and who elevate into an unnecessary importance conditions which are but trifling.

In all first-class schools of medicine students are taught to study their dispensary and hospital cases according to a systematic plan. Such a method is an admirable and necessary one on account of the training it gives, but it is needful to remind the student that, in private practice, the case-taking card may not, in many cases, be rigorously followed; he may vary his method for particular reasons in special instances.

The following plan is a somewhat modified form of the card in the University of Edinburgh—drawn up by Professor A. R. Simpson:

ANAMNESIS.

1. NAME; AGE; OCCUPATION; RESIDENCE; MARRIED, SINGLE, OR WIDOW; DATE OF ADMISSION.
2. COMPLAINT AND DURATION OF ILLNESS.

3. GENERAL HISTORY OF—(a) Present attack; (b) previous health; (c) diathesis; (d) social conditions and habits; (e) family health.
4. SEXUAL HISTORY.
 - (1) *Menstruation*—
 - A. Normal—(a) Date of commencement; (b) type; (c) habit—Duration.
Quantity.
 - (d) Date of disappearance.
 - B. Morbid—(a) Amenorrhea; (b) menorrhagia; (c) dysmenorrhea.
 - (2) *Intermenstrual discharge*—(a) Character; (b) quantity.
 - (3) *Pregnancies*—(a) Number; (b) dates of first and last; (c) abortions; (d) character of labors; (e) puerperia; (f) lactations.
5. LOCAL FUNCTIONAL DISTURBANCES—(a) Bladder; (b) rectum; (c) pelvic nerves and muscles.
6. GENERAL FUNCTIONAL DERANGEMENTS—(a) Nervous system; (b) respiratory system; (c) circulatory system; (d) digestive system; (e) emunctories.

PHYSICAL EXAMINATION.

1. GENERAL APPEARANCE AND CONFIGURATION.
2. MAMMÆ.
3. ABDOMEN—(a) Inspection; (b) palpation; (c) percussion; (d) auscultation; (e) mensuration.
4. EXTERNAL GENITALS.
5. PER VAGINAM—(a) Orifice; (b) walls and cavity; (c) roof; (d) os and cervix uteri.
6. BIMANUAL EXAMINATION (abdominovaginal, rectovaginal, abdominorectal, abdominorecto-vaginal).
 - (1) *Uterus*—(a) Size; (b) shape; (c) consistence; (d) sensitiveness; (e) position; (f) mobility; (g) relations.
 - (2) *Fallopian tubes*.
 - (3) *Ovaries*—(a) Size; (b) situation; (c) sensitiveness.
 - (4) *Peritoneum and cellular tissue*.
 - (5) *Bladder*.
 - (6) *Rectum*.
 - (7) *Pelvic bones*.
7. INSPECTION of vaginal, rectal, and vesical cavities.
8. USE OF—(a) Speculum; (b) volsella; (c) sound; (d) dilators; (e) curet; (f) aspiratory needle.
9. PHYSICAL CHANGES IN—(a) Nervous; (b) respiratory; (c) circulatory; (d) digestive; (e) emunctory organs; (f) skin; (g) bones.

DIAGNOSIS.

PROGNOSIS.

TREATMENT.

PROGRESS AND TERMINATION.

ANAMNESIS.

It is most important that this plan should be carefully mastered by students. It is not to be hastily crammed at the last moment, immediately before their clinical examinations, nor to be held in their hands while taking a case, and used as a mere mechanic guide of procedure. A thorough mastery of the scheme involves a wide clinical knowledge, and the various divisions are arranged in a form convenient to the grouping of the details of information which we obtain for comparison with the records of past experience.

In division 1 there are some points of importance to be noted by students. The age of the patient must be determined, and the special disturbances which are found at puberty, during the period of sexual activity, and at the menopause must be borne in mind. The occupation must be known; chiefly in this connection must we inquire whether the woman has too much work, lifts heavy weights, stands too much, or works under unfavorable conditions. It is equally important, also, in certain other cases, to know whether the woman is one of those who have too little to do, or spends her life in idleness and excessive indulgence. The place of residence is noted as a matter of routine, but in certain cases it may be of some importance in relation to the health; thus the patient may be living in a district where rheumatism is prevalent, or she might have spent some time in a tropical climate.

In finding out whether the patient is married, single, or widowed, tact is necessary. Sometimes the patient volunteers the information, but generally it must be elicited. Awkward blunders are often made by students, *e. g.*, asking a widow if she has pain on coitus, or a newly married woman as to when she last had a child. It must be remembered, also, that widows and unmarried may come as patients either in a state of pregnancy or suffering from some condition following an immoral relationship.

The examination of such a case must be conducted most cautiously. The physician may be suspicious, but he must be very careful in his questions lest he might be mistaken. Moreover, he must be prepared for deliberate falsehood from many patients, and he must take care not to be thrown into error. Also in cases where the physician suspects some venereal complication, he must frame his questions in the most careful manner, in order not to arouse the suspicions of the patient, who may be an entirely innocent sufferer.

Division 3 refers to some points which must be inquired into with care. The history of the illness of which the patient complains must be obtained most carefully. In some cases this is definite and distinctive enough to justify an immediate diagnosis, but in the great majority of gynecologic troubles the indefiniteness of the history is most perplexing to the student. In the general run of cases previous health is not minutely inquired into, but it is necessary that nothing important be overlooked; *e. g.*, if the patient had had rheumatic fever some years previously, the neglect to find this out and to examine the heart might lead to very serious consequences. Moreover, if the patient be married, it is most important to compare her health before with that after marriage.

Diathesis and family health are not particularly considered in a large number of cases, but sometimes they may have an important bearing. Hereditary tendencies must sometimes be noted, *e. g.*, mental diseases, tuberculosis, tumor-formation, hemophilia. The social condition and habits of life are important points for consideration. Overwork, imperfect feeding, poverty, bad sanitary conditions, luxury, vicious living, care, and worry have an important bearing in many cases.

Division 4 requires to be considered with the greatest care and exactness. It deals with the sexual history. The normal menstrual history must be inquired into, and it is important that the student bear in mind all the variations found in connection with normal menstruation. I note some of these.

The date of commencement or period of puberty occurs at varying

periods. It is influenced by various factors, *e. g.*, climate, environment, race, heredity.

It must be remembered that there are variations in the method of the establishment of the function of menstruation, *e. g.*, it may take place gradually, intermittently, or suddenly. In some rare cases in our country menstruation may begin in childhood, at eight or ten, or may be delayed until the age of twenty, twenty-two, or even twenty-five. And these extremes may be found where the girl is quite healthy. In most cases of delay, however, there is some pathologic cause. In particular, the serious condition of malformation of the genitals, *e. g.*, atresia vaginæ, must be kept in mind.

Type refers to periodicity. It is the interval from the commencement of one to the commencement of the next menstruation (not, as is often said by students, "from the end of one to the beginning of the next"). In most cases the twenty-eight-day type is found. In a small proportion the thirty-day, the twenty-one-day, and a few other types are found. In the great majority of cases the type is regular, the patient being healthy, *i. e.*, the number of days is always the same. But it must be remembered that in some women irregular types are found not associated with any unhealthy state. As an example, I may mention one case in which, throughout a number of years, the woman had a mixture of twenty-one, twenty-five, and twenty-eight-day types.

Habit refers to the duration and quantity of the flow. Normally, considerable variations are found. Thus it may last from two to eight days; occasionally for nine days, the woman being quite healthy. A very large number of women have a discharge of blood for about a week. The amount of discharge lost is normally from three to nine ounces. Generally, six or seven ounces are lost. The estimation of the quantity by means of diapers is unreliable, because of the variations in the habits of women as regards cleanliness. Some wear half a dozen where three would suffice, while others make three or four perform the need of eight or ten. Each woman in a state of health loses a fairly constant quantity at each period. On the average, perhaps, three or four diapers are used in twenty-four hours.

The date of disappearance of the menstrual function is a variable one. This cessation is one of the phenomena met at the menopause, a period also known as the critical time, the turn of life, the change of life, or the climacteric. In about 50 per cent. of women it takes place between forty-five and fifty; in about 25 per cent. between forty and forty-five; in about 12½ per cent. before forty; in about 12½ per cent. after fifty. In a few cases it may occur between twenty and thirty, or as late as between sixty and seventy. These advanced periods have been mentioned, but it is doubtful if they were not pathologic. It is very rare to find a woman in a normal condition menstruating after fifty-five.

Stoppage of menstruation is not synonymous with change of life. It is merely one of many phenomena. The change of life may take place quickly or slowly. Usually its duration is from one to three years. It is most important that the student should bear in mind the various methods in which the menstrual function ceases, whether gradually, suddenly, or intermittently; and he should remember the diseases which are apt to occur at this period of life, and which may alter the normal menstrual condition.

It is often important to compare the menstrual function in the single and married state of the patient.

After the study of the normal, the morbid menstrual history should be investigated. It is of great importance that, at this stage, the student should be able to make a mental summary of the causes of the various abnormal conditions to be investigated.

Amenorrhea means diminution or cessation of the menstrual flow. Students, as a rule, state in examination that it is "stoppage of the flow"; this is only a partial answer. A woman who normally menstruates for eight days, but who has gradually altered so as to menstruate for two days, is amenorrheic, just as surely as if she had stopped altogether.

Menorrhagia means increased menstrual discharge, and may be expressed in terms of quantity or duration, or of both. The variations normally found in women must be borne in mind. What is abnormal for one may be normal for another.

Dysmenorrhea means pain associated with the menstrual flow. Normally, in a certain number of cases no pain or discomfort is felt; in the majority of cases there is a dull backache or aching in the loins. Pains may be sharp or dull, dragging, down-bearing, or labor-like, and may be in the loins, in the small of the back, in the pelvis, or shooting into the thighs. They may be felt at different times, namely, for a day or two before the flow commences, ceasing at the commencement; for a day or two before as well as for the first day or two of the flow; during the first day or two only; during the whole extent; during the last two or three days and for a day or two after the stoppage of the flow.

Intermenstrual discharges are of various kinds.

Metrorrhagia means uterine hemorrhage occurring at times other than the menstrual periods. In this connection must be remembered the irregular discharges of blood often found during the period of puberty before menstruation is well established, and also during the period of the menopause. The irregularity of type in certain women in a state of health must also be kept in mind.

Leukorrhea is the most common intermenstrual discharge. In its most common form it is called popularly "whites." This discharge may proceed from vulva, urethra, vagina, cervix, or body of uterus. It may be variously colored, *e. g.*, white, gray, yellow, green, etc., according to whether urine or blood be mixed with it, or according to the nature of the germs which may be growing in it. It is mucopurulent, the constituent elements varying in different cases, or it may be watery and acrid. It may be odorless, or may have an odor which in some cases may be extremely bad. The discharge may in some cases be mixed with blood or urine.

The **pregnancy history** must be carefully considered. It is important to know the number of pregnancies, especially in relation to the duration of married life. Too frequent conception is a serious factor in several diseased conditions. The dates of the first and last pregnancy must be known; conception, before nubility is well established, is a condition which may lead to disturbed health.

It is especially necessary to know the abortion history of the patient, for to abortion and its consequences much ill-health in women is due. The character of the labors must be known, *e. g.*, whether they were easy, prolonged, difficult, or whether they required the assistance of the physician. It is

necessary not to be misled by the patient's statements in regard to this point. Often a patient will state that she had a bad labor, or perhaps will say that instruments were used when she has only had chloroform.

It is also necessary to inquire as to how the patient recovered from her labors—whether she had suffered from pelvic inflammation during the puerperium, whether she rose too early, worked too soon, or carried her baby much. Some important gynecologic troubles date from an abnormal puerperium.

Lactation has an important bearing on certain conditions, and the physician must know whether the patient nursed her children, and for what length of time.

Coitus must be inquired into in some cases. It should only be done when absolutely necessary and with the greatest caution and delicacy. It may sometimes be difficult to elicit facts regarding some abnormal state, *e. g.*, dyspareunia, even though the patient has come to consult the physician for nothing else. Coitus may be impossible in certain cases. In the general run of such cases the condition is made known to the physician within a few weeks or months of marriage. The cause may lie with husband or wife. If with the latter, toughness of the hymen, malformation, dyspareunia, or other conditions may be found. If the condition develops after some extent of married life, other causes must be thought of, *e. g.*, inflammatory conditions, new-growth formation, etc.

Excessive coitus may have an important bearing on certain conditions, but it is difficult to get information on this matter in many cases. Questions must be asked with the greatest delicacy, but they are rarely necessary. Sometimes a physician may suspect that a woman is doing injury to herself by using methods for preventing conception. It is difficult to find out the truth in such cases. Women who practise this habit will readily tell falsehoods to a doctor.

An important abnormal condition to be considered is **dyspareunia**—difficult or painful coitus. This condition is a most important one in relation to the health and happiness of a woman. The causes to be kept in mind are many, *e. g.*, awkward attempts at coitus, disproportionate size of the male organ and vagina, imperfect development of the female parts, inflammatory conditions in vulva, vagina, uterus, pelvic peritoneum, cellular tissue, ovaries, and tubes; displacements of uterus, prolapse of ovaries, urethral caruncle, fissures of ostium vaginae or of anus, ulcers of rectum, piles, coccygodynia, tender carunculæ myrtiformes, vaginismus from whatever cause.

Local functional disturbances of bladder, rectum, pelvic nerves, and muscles form a very important field for investigation.

Very often the bladder symptoms are the most valuable in leading the physician to a diagnosis. To neglect this viscus may lead to very serious error.

The state of the rectum must be known. The frequency of defecation should be found out. Often women will state that they are all right when the bowels move every three or four days. If diarrhea is present, its duration and nature should be investigated; sometimes it is caused by the irritation of an overloaded bowel. The various causes of these symptoms must be remembered, especially new-growths inside and outside the bowel; ulcerations, simple or malignant; and pressure from various conditions, *e. g.*, retroflexed and

enlarged uterus, hematocele, inflammatory deposits. Pain associated with defecation must be inquired into. It may be found before, during, or after the act, and may be due to anal fissure, ulcer, malignant disease, etc. Mucus or blood may be found in the motions, and the causes should be borne in mind, *e. g.*, ulceration of bowel, new-growth formation, piles, and other causes.

Disturbed function in the muscles which are in the pelvic floor is to be investigated. There may be a spasmodic condition of some, *e. g.*, the sphincter vaginae. But the important points to consider are weakness and solution of continuity, *e. g.*, rupture of the perineal body. The most frequent cause of these is to be found in connection with child-bearing.

The state of the pelvic nerves is, in the majority of cases, considered only in regard to the production of pain, which is the commonest symptom among gynecologic patients. This symptom may be but one of a series of hysteric phenomena, but it is often due to inflammation in uterus or appendages, peritoneum or cellular tissues, pressure of new-growths or other swellings. But the patient may also complain of numbness, cramps, and hindered movements in the lower limbs.

The last division, dealing with functional derangements of the various systems of the body, requires a little attention.

In a great many gynecologic troubles no routine examination is made of these systems. Perhaps too often is there carelessness in this direction, and it may be necessary to warn the physician in regard to it. It is of the utmost importance that no condition be overlooked which might have some bearing in relation to the symptoms of which the patient complains or to the cause of the affection.

For example, a case with symptoms pointing to cystitis has been treated as a purely local affair, and it has turned out afterward that the symptoms were really due to tubercular disease of the kidneys.

Of all the systems, I desire particularly to point to the *nervous* and *alimentary* as being of chief importance. The disturbances of the nervous system known as neurasthenia and hysteria, in all degrees of their manifestations, must be kept in mind in the consideration of every gynecologic case.

In very many cases symptoms are referred to the pelvis which have no local explanation, but which are merely part of an extensive range of abnormalities due to the abnormal nervous state. Or, in such a condition, pelvic symptoms which have been slight may become enormously exaggerated.

Much error has been committed in practice by concentrating attention upon the local and forgetting the general—the very worst possible course to pursue. Sometimes, after having undergone various tinkering in her genital tract without improvement, a patient may sink into a condition from which only the most judicious treatment can raise her.

Various disturbances of the alimentary system, especially dyspepsia and constipation, are to be inquired into. The relationship between these conditions and symptoms referred to the pelvis is important; also the relationship between pelvic troubles and reflex disturbances of stomach and bowel is a matter of the highest importance in treating disease in women. Sympathetic or referred symptoms are very common.

PHYSICAL EXAMINATION.**GENERAL APPEARANCE AND CONFIGURATION.**

The physician should note while the patient is walking, sitting, or standing, or during the rest of the examination, whether there are any deformities to be seen, *e. g.*, of spine, pelvis, or lower limbs. Such conditions are important in relation to child-bearing. Abnormalities of gait and posture should also be looked for; also, pendulous belly, swellings in the abdominal region. The condition of the face must be noticed, *e. g.*, it may indicate a neurotic temperament, malignant disease, or some other trouble.

MAMMÆ.

In examining the mammæ, the following points must be noted, namely, size, general or local swellings, amount of fat, consistence, tenderness, venous enlargement; the condition of the nipple, whether prominent, retracted, tender, fissured; prominence of sebaceous glands around nipples—the so-called tubercles of Montgomery. Pigmentation should be noted; whether there be the primary areola around the nipple. The presence or absence of colostrum or milk should be determined; in compressing the breast both hands should gradually squeeze the gland from the periphery to the nipple.

In some cases, *e. g.*, unmarried girls in whom pregnancy is suspected, one may sometimes, at an early stage of examination, desire to know the condition of the breasts. In order not to arouse any suspicions on the part of the patient, it is best not to squeeze the gland at once, but to palpate it, inquiring for painful areas; while so employed, one may be able to find out whether any colostrum is present.

ABDOMEN.

For the examination of the abdomen, the patient must lie on her back on the couch or examination table. In exposing the skin-surface, two methods may be employed. The most thorough is the following: The patient loosens the waist-fastenings of her dress and skirts and lies on her back, her body being covered with a sheet. Under this cover the skirts are drawn down to the level of the pubes. The upper margin of the sheet is then placed just above the mons veneris. The bodice and corset are next loosened in their lower part, and the chemise drawn up, so as to leave the abdomen quite bare. A less thorough method is to draw the patient's clothes up under the cover as she lies on her back. The sheet is then turned down, without exposing the hairs of the mons veneris; the skirts are pulled up by the patient, and a considerable portion of the abdomen is exposed.

Inspection.—The following points should be kept in mind in looking at the abdomen: The shape, general or local swelling, state of nutrition, retraction; the condition of the umbilicus, *i. e.*, whether it has the normal dimple, whether flattened or projecting; striæ, old or recent, due to stretching of the abdominal walls from various causes, *e. g.*, pregnancy, tumors, etc.; pigmentation; distention of veins in the wall; pulsation; influence of respiration on swellings; movements of fetus in pregnancy, which may first be seen about

midterm in thin-walled women; movements of intestines in thin-walled women.

Palpation.—Patient's knees should be drawn up, and she should breathe quietly with open mouth, or should sigh deeply. The hands of the examiner should be well warmed, and should only gradually be applied to the abdomen. It is best that the patient's bladder and rectum should be emptied beforehand.

The palpation should be gentle, though firm. If it be desired to adopt the method of suddenly forcing the finger-tips into the abdominal wall, it should not be tried until gentle palpation has been made. Often if the patient be forcibly palpated at first, she will not relax the wall afterward.

In some cases the whole abdomen must be examined carefully, and the student should not forget the four areas into which the abdomen is divided.

By palpation we may gain information regarding the following: Consistence of walls, state of nourishment, tenderness, tension; presence of tumors, their size, nature, mobility, relation to respiration, attachment to abdominal wall, relation to pelvis; presence and nature of other swellings, *e. g.*, ascites, hernias, glandular enlargements; fetal parts, ballottement.

Percussion.—It is important to bear in mind the necessity of light as well as of forcible percussion. We gain information by this method regarding the size and position of the viscera; outlines of swellings and the relations of intestines to them; differential diagnosis between free abdominal fluid and tumors, *e. g.*, ovarian cyst, or fixed masses of abdominal fluid.

Percussion of the abdomen may be made while the woman sits or lies on her side. Some recommend distending the bowel by gas or fluid in order to make more evident its extent for the purpose of comparison with some swelling under consideration.

Auscultation.—This method is applied to the abdomen for the purpose of making out the following: Fetal movements, which may be heard several weeks before the mother can feel them, fetal heart-sounds, fetal heart murmurs, funic souffle; uterine souffle of pregnancy; souffle of fibroids; pulsation of aorta; friction-sounds of roughened peritoneal surfaces rubbing

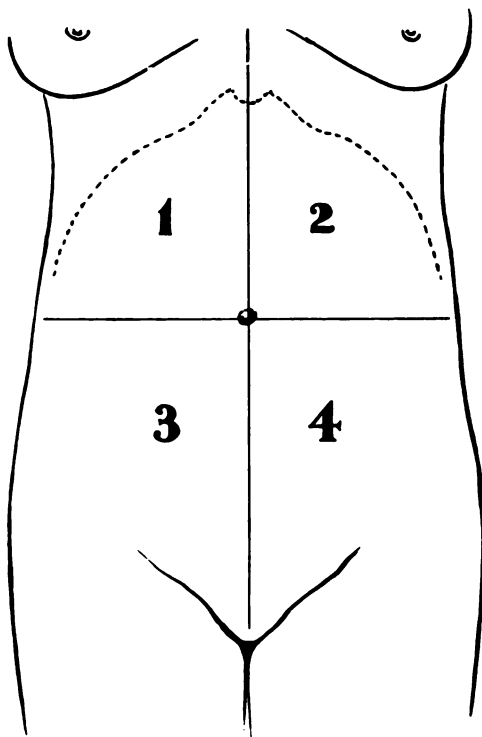


Fig. 83.—Division of abdomen into four quadrants.

together; gurgling murmurs due to gas and feces in the bowel, the succussion murmur, the cracking sounds made by the bursting of small bubbles in the intestine.

Some of these intestinal sounds are often mistaken for friction-sounds.

Mensuration.—Measurements of the abdomen are made chiefly with reference to the estimation of the size of abdominal swellings, especially for the purpose of estimating their increase or diminution in size during a period of weeks or months. A measuring tape is generally sufficient, but a cyrtometer, made of strips of flexible lead, may also be used. It is necessary to make definite measurements, namely, from the ensiform cartilage to the pubes; from the umbilicus to the ensiform and to the pubes; from the umbilicus to the anterior-superior iliac spines; from the ensiform to the anterior superior spines; around the body at the level of the umbilicus—the greatest circumference; from the tip of the spine of a vertebra to the middle line in front.

In order that the comparisons from time to time may be exactly made, it is necessary that the patient should always be measured in the same position; the bowels should not be distended with gas and feces; the diminution or increase of fat on the body-wall should be taken into account.

In some cases a complete and satisfactory examination of the abdomen can be made only when the patient is under an anesthetic.

EXAMINATION OF EXTERNAL GENITALS.

It is not necessary to inspect the external genitals as a routine practice. It should be done as little as possible in ordinary consulting-room work. The patient is placed on her side, her feet being opposite a window. She is covered with a sheet, and, after her knees are drawn up, the clothes are pulled up and the pudenda exposed.

The lithotomy position may also be used, but only where absolutely necessary. This is undoubtedly the most convenient position when an anesthetic is employed. For thorough examination of the parts the labia must be separated with the fingers. The following conditions should be looked for: Malformations, varix, edema, pigmentation, discharges, inflammation, fissures, venereal or malignant disease, swellings, injuries, state of the hymen, state of the urethral orifice. The patient may be asked to cough or bear down in order that the effect on the perineum or vaginal walls may be noted.

DIGITAL EXAMINATION OF THE VULVA AND VAGINA.

This examination may be made when the patient lies either in the left lateral or lithotomy position on a table or sofa. The latter is the most convenient, but the former is usually less embarrassing to the patient. Whichever method be adopted, there should be as little exposure of the genitalia as possible; the patient's lower limbs should be protected by a large sheet or thin coverlet, under which the clothes may be raised toward the hips.

The author recommends the use of thin rubber gloves, which have been cleansed by boiling, for all gynecologic examinations. They may be lubricated

with boroglycerin or soap and water. If gloves are not used, the hands should be well washed and warmed.

The examiner must avoid the region of the clitoris. The student must be particular to begin well to the back in the region of the anus, and to pass the fingers carefully forward. When the anterior edge of the perineal body is reached, both fingers may be at once inserted into the introitus vaginæ, if there be no doubt that it is large enough, *e. g.*, in a multipara. In a doubtful case, *e. g.*, in a nullipara, only the forefinger should be at first used. In introducing the finger-tips they should not press the anterior parts against the symphysis, and the clitoris should not be touched.

In passing the fingers upward, they should be directed into the hollow of the sacrum, the perineum being pressed backward in avoidance of the anterior delicate structures. In a case where the introitus is small, it is often advisable to ask the patient to bear down strongly while the finger is gradually pushed upward.

The following points are to be borne in mind during the examination: size and tenderness of the introitus vaginæ; condition of hymen or carunculæ myrtiliformes; integrity of perineum; abnormal or diseased conditions of external genitals; size, temperature, moisture, rugosity, smoothness, distensibility of vaginal walls; sensitiveness, swellings in or outside the walls; polypi or other structures in the cavity; solutions of continuity in the walls; state of urethra, base of bladder, and ureters; condition of rectum; size and state of cavity and outlet of bony pelvis.

The size, shape, and consistence of the vaginal portion of the cervix are noted; its mobility; whether it is split or intact; whether it is abnormally directed.

The size, shape, and consistence of the os uteri are to be made out. The condition of the fornix or vault of the vagina is to be noted, but it is to be borne in mind that the investigation of conditions outside the vagina, which may be in relation to the fornices, is best carried out by means of the bimanual examination.

It is necessary to be careful with regard to the examination of certain cases. If a mistress demands a vaginal examination of a servant who is suspected to be pregnant, the physician should refuse it. If an unmarried woman, having been accused of illicit connection, asks for an examination and a certificate that she is not pregnant, it is best not to accede to her request.

BIMANUAL EXAMINATION.

This is the most satisfactory means of gaining information with regard to pelvic conditions. There are several varieties of this method—*e. g.*, abdominovesical, abdominovaginal, abdominorectal, abdominovesicovaginal, abdominorectovaginal, abdominorectovesicovaginal. The most commonly employed is the abdominovaginal, and this will be considered first of all. In every case the bladder and rectum should be empty.

Abdominovaginal Bimanual.—In consulting-room practice, the following method is the best to adopt. After the patient has loosened the fastenings of her skirts and corset, she should be placed on a sofa or special table

in the dorsal position, the knees being well drawn up and separated. A large sheet is placed over her lower limbs, while her skirts are drawn well above the knees. It is best that the back should rest on a plane which slopes upward somewhat toward the head. The knees should be drawn up and well separated. The physician's warmed left hand should be placed on the patient's abdomen, the finger-tips at the umbilicus. The patient should



Fig. 84.—Method of making an abdominovaginal bimanual examination.

breathe quietly and deeply with her mouth open. If she restrains her breathing, she should be asked to make deep sighs.

This hand is then gradually pressed downward and backward toward the inlet of the pelvis, the ulnar edge rather than the surface being toward the abdomen. The fingers of the right hand which are in the vagina are pushed well upward until they touch the fornix and the cervix. The last two fingers of this hand are flexed on the palm or lie in the hollow between the buttocks. Students often make the mistake of placing the outer hand on the symphysis

and pushing downward and backward immediately above it, in this way disturbing the position of the uterus.

The examination should be conducted in the most systematic manner. The uterus should at first be made out—its size, shape, consistence, sensitiveness, position, mobility, and relationships determined.

The Fallopian tubes and ovaries should be investigated with regard to the same points. In normal cases, unless the abdomen be very thin-walled, the tubes are not often felt.

The peritoneum and cellular tissue within reach of the examining fingers should next be palpated in regard to deposits, collections of fluid, tumors, old cicatrices, sensitiveness.

The bladder may be palpated in regard to sensitiveness, inflammations, thickenings, tumors, calculi, distention or thickenings of ureters.

The anterior part of the rectum and the condition of the rectovaginal septum may, to a certain extent, be examined by the vaginal fingers, but for thoroughness the rectovaginal examination should be made.

The condition of the brim of the cavity and of the outlet of the bony pelvis may be made out—abnormal measurements, deformities, enlargements of bone, shape, mobility, and tenderness of coccyx, condition of sacrosciatic ligaments and levator ani muscles.

The student, in particular, should bear in mind the following points in making the abdominovaginal bimanual: Through the anterior fornix one may feel the body of the uterus, the bladder, ureters, round ligaments; rarely a pregnant Fallopian tube, a prolapsed ovary, a blood extravasation, inflammatory effusions, may be found; sometimes a subperitoneal fibroid. When the uterus is retroverted, coils of intestine will be found in the uterovesical pouch.

Through the posterior fornix the following may be distinguished: feces or other swellings in the rectum; blood or inflammatory deposits in the peritoneum or cellular tissue; prolapsed tubes and ovaries, normal or enlarged from various causes; retroverted body of the uterus; fibroid of posterior wall of uterus; malignant growths; ascites.

Through the lateral fornices the state of the broad ligaments, tubes, and ovaries may be investigated in regard to cysts, tumors, inflammations, cicatrices, blood extravasations, etc.

Finally, it must not be forgotten that in the pelvis may occasionally be found certain abdominal organs or growths in connection with them, *e. g.*, the kidneys or spleen; also growths of omentum, bowel, peritoneum, etc.

The abdominorectovaginal examination is more valuable than the method just described, not only because the condition of the rectum is investigated, but because the rectal finger can explore the condition of the posterior part of the pelvis very easily through the thin rectal wall. It is not a pleasant method either for patient or physician, but it should be employed in every case where the other bimanual examination is not satisfactory. Having finished the ordinary bimanual, the middle finger should be withdrawn from the vagina and passed gradually into the rectum. It should be pushed well up through the folds of the third sphincter, $1\frac{1}{2}$ inches above the anus; these sometimes obstruct the finger.

The abdominovesical, abdominovesicovaginal, and abdominorecto-

vesicovaginal examinations are made chiefly for the investigation of bladder conditions, but are rarely, if ever, necessary.

The abdominorectal examination is important. It is carried out in virgins when it is not considered advisable to pass a finger through the hymen, in atresia, shortness or narrowness of the vagina, in cases in which a tumor fills the vagina, in malformations of the internal genitals, for the purpose of studying the condition of coccyx, rectum, or rectovaginal septum.

The forefinger is used. It should be lubricated, and gradually passed



Fig. 85.—Method of making an abdominovaginorectal bimanual examination.

through the anus with a slight rotatory movement. With it the state of the sphincters, sensitiveness of the parts, the presence of fissures, tumors, piles, or prolapsus may be made out. Above the anus the wide ampulla is entered, and the third sphincter passed. The following structures may then be palpated: posterior vaginal wall, cervix, posterior part of body, uterosacral and broad ligaments, tubes, ovaries, posterior bony wall of pelvis; also, pathologic conditions in these various structures.

Those who have not been accustomed to this method of examination are at first generally in doubt as to the relations of the uterus; the cervix may be mistaken for the body or for a tumor.

Bimanual examinations must be conducted with special care in acute inflammatory conditions, in recent blood extravasations, in distended tubes, in ectopic pregnancy, in all thin-walled cysts, in advanced cancer of cervix or rectum.

In a great many cases a satisfactory examination can be obtained only when the patient is anesthetized, *e. g.*, when she is very fat, when she keeps the abdominal wall rigid, or when there is much tenderness or pain.

When under the anesthetic, the patient should be examined in the dorsal or lithotomy position.

Vagina.—The vagina may be exposed and examined by means of the speculum. I will consider this method when describing this instrument. The canal may be inspected without the use of a speculum in two ways:

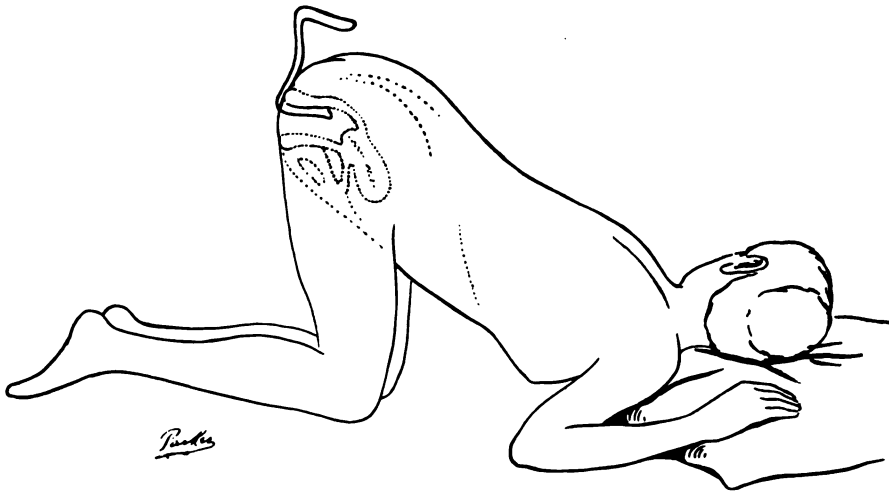


Fig. 86.—Ballooning of vagina following admission of air when a woman is placed in the genupectoral posture.

(1) If the patient be placed in the genupectoral position, and the introitus opened with the fingers, air rushes in, and the canal becomes distended. If the perineum be held back by a finger, and the light from the window or an artificial light be reflected into the vagina, its walls and the vaginal portion of the cervix may be well seen.

The same result may be obtained in a multipara if the Sims position be employed.

(2) If the patient, while in the lithotomy position, has her hips elevated somewhat, and the introitus be opened, air rushes in and distends the vagina, while the uterus gravitates toward the promontory. By means of a reflected light the cavity may be examined while the labia are separated and the perineum is pulled back.

Rectum.—(a) *Digital Method.*—I have already described the method

of examination by means of a finger. (Simon has recommended the introduction of the whole hand. Such a barbarous method is never necessary, and must be condemned.)

(b) *Storer's Method*.—The patient is placed on her side with her knees drawn up, her buttocks being opposite the source of light. One or two fingers are passed into the vagina, and pressure is made downward and backward through the posterior vaginal wall; if, at the same time, the anus be opened with the fingers of the other hand, the anterior rectal mucosa can be everted and made visible.

(c) *Use of the Speculum*.—A favorite rectal speculum is of the tubular variety; its inner surface should be a reflecting one. On one side is a fenestrum. The instrument may be made of polished metal or of glass, silvered and covered with vulcanite.

It is best used while the patient is in the lithotomy posture. When it is passed through the anus, light is reflected into it, and it is rotated in order to bring different portions of the wall into relation with the fenestrum.

Another valuable speculum is a bivalve, the blades of which may be considerably separated.

These methods allow of very imperfect inspection of the rectum. The following are far more satisfactory, enabling the physician to examine a large area of the lower bowel. They are based upon the same principle which underlies the best method of examining the female bladder, viz., the admission of air while the pelvis is elevated to allow the intestines to gravitate toward the chest, so that atmospheric pressure may balloon the passage. In the great majority of cases the bowel may be well dilated. When the patient is very stout or where pelvic pathologic processes exist to interfere with the movement of the bowel-wall, only partial distention may be obtained.

(d) *Genupectoral Posture*.—In this position, if the anus be opened, the air rushes in, distending the rectum. If the anus be kept widely opened by means of the fingers or with retractors, the interior of the bowel may be studied by means of sunlight or by reflected artificial light.

(e) *Elevated Lithotomy Posture*.—This position is best obtained by using a table on which the patient may be placed in the lithotomy position, and which allows the hips to be elevated so that they are about twenty inches above the normal level of the top of the table. The weight of the body is supported by flat, curved steel supports placed against the shoulders.

When the anus is opened with the fingers or with a retractor, the air enters, dilating the rectum for several inches. If a large round speculum be introduced, the cavity may be inspected by means of reflected sunlight or artificial light. The portion of the bowel above the distended area may be examined through a long tubular speculum.

This method is far more satisfactory than any other, and it allows the physician to work with ease.

When the proper table is not at hand, the hips may be elevated by means of hard pillows, but the results are not at all so satisfactory, owing to the flexing of the abdomen which is brought about.

BLADDER.

Various methods have been employed for the purpose of gaining information concerning the state of the urethra and bladder.

(a) **Abdominovaginal Bimanual Examination.**—The ordinary bimanual examination frequently enables the physician to ascertain facts regarding the consistence, sensitiveness, mobility, and relationships of the bladder



Fig. 87.—The author's method of examining the female bladder when the patient is placed in the elevated lithotomy position.

and ureters, the presence of calculi, new-growths, etc. In many conditions, however, it cannot furnish at all accurate information.

(b) **Digital Examination.**—Until within recent years digital exploration of the interior of the bladder was widely practised, the urethra being dilated to permit introduction of the index-finger. This method must now be

regarded as entirely unnecessary, because cystoscopic examination is better and safer. Dilation of the urethra, sufficient to enable the finger to be passed through it, cannot be carried out in girls or elderly women without great risk of permanent incontinence of urine; this is also apt to result in women between these age limits. The information to be derived from



Fig. 88.—Boldt table adapted by the author for the examination of the bladder, when the woman is placed in the elevated lithotomy posture.

internal palpation is so slight as to be of no avail in the great majority of cases.

(c) The bladder may also be examined with a metal **sound** in cases in which stone or small phosphatic deposits on the bladder-wall are suspected. Stones of any size but the very smallest may be made out on bimanual examination.

(d) Sometimes the base of the bladder may be opened into by a **mesial incision** through the interior vaginal wall in order that the vesical mucosa may be examined. Such a method is employed only where it is thought that some operative treatment may follow, *e. g.*, the removal of a tumor or where it may be necessary to drain the bladder into the vagina.

(e) **Ordinary Specular Examination.**—An ordinary small tubular speculum with a reflecting inner surface may be used for the examination of the bladder, the patient being placed in the lithotomy position. Aseptic precautions are used, and the urethra is dilated sufficiently to admit the



Fig. 89.—Examination of bladder with the patient in the elevated lithotomy posture.

speculum. Light is reflected into the instrument. This is an unsatisfactory method. The urine trickles into the end of the speculum and the bladder-walls fall over it, so that it is difficult to examine the mucosa systematically and thoroughly. The walls of the urethra may be studied by means of a tubular speculum fenestrated on one side, as recommended by Skene.

(j) **Examination Through a Tubular Speculum, the Bladder being Distended with Air.**—H. Kelly has done important service in advocating this method, which is by far the most valuable in the study of the *female*

bladder. For several years it has been known that when the pelvis is raised higher than the chest, the weight of the abdominal contents is directed toward the diaphragm, and that if the vagina be opened to allow air to enter, the atmospheric pressure distends or balloons the vaginal canal, so that the wall is considerably stretched, its capacity being increased in all directions. The same change is noticed when air is admitted into the rectum. Kelly observed that the bladder is similarly distended when air is allowed to enter it, and recommended the introduction of light through a speculum for the purpose of

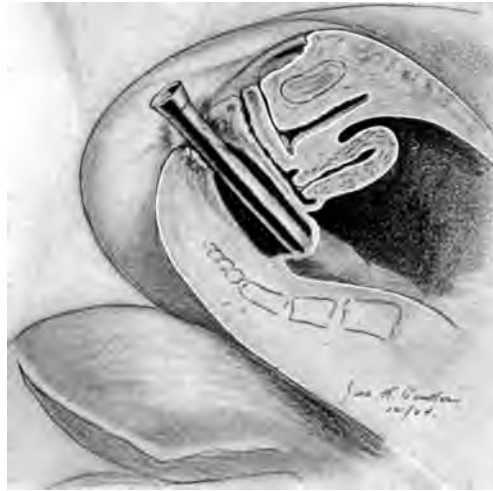


Fig. 90.—Examination of rectum with the patient in the elevated lithotomy posture.

examining the interior of the bladder and ureters, and of carrying out various therapeutic measures. The method is a very simple one, and of inestimable value both in diagnosis and in treatment.

Posture.—In his earlier papers describing his method of examining the female bladder Dr. Howard Kelly recommended that the necessary elevation of the pelvis be obtained by placing pillows under the hips as the patient lay on a flat table in the lithotomy position. More recently he has advocated the genupectoral posture as more advantageous.

Each of these methods has certain disadvantages. When the first posture is adopted, the examination is frequently unsatisfactory. The elevation necessarily leads to a flexing of the upper part of the abdomen on itself. This interferes with the free descent of the intestines toward the diaphragm, which is necessary to the complete distention of the bladder with air. The hips cannot be raised much above twelve or fourteen inches without discomfort to the patient if she be not anesthetized, and if an anesthetic be employed, the cramping of the abdomen interferes with free respiration. In women with tense or fat abdominal walls it is often impossible to obtain distention of the bladder by this method.

The genupectoral posture, while undoubtedly very favorable to bladder distention, is very unpleasant to the patient if she be not anesthetized, while if an anesthetic is used, its administration is very awkwardly carried out. The patient's neck is apt to be much bent, and if she vomits or secretes mucus freely, there is often trouble in managing these complications satisfactorily. Moreover, the position of the examiner is not apt to be at all comfortable, especially in catheterizing the ureters.

In 1897, in the Royal Victoria Hospital, Montreal, I used a wooden table for the purpose of obtaining a greater degree of elevation of the hips than was possible by the use of pillows, and which was not accompanied by flexing

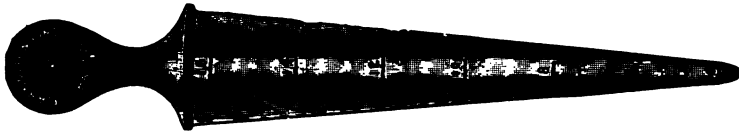


Fig. 91.—Kelly's urethral calibrator.

the abdomen. Since 1898 I have used the ordinary Boldt operating table, and find it very convenient in making the examination.

The patient is placed in the lithotomy position on the table, while the top is horizontal, the legs being fastened to upright rods attached to the table-top, and the buttocks projecting slightly over the end of the table. Steel bars with padded supports are attached to the top of the table so as to support the shoulders. After the external genitals and vagina are cleansed and the patient is enveloped in sterile sheets, the urine is withdrawn from the bladder, the urethra is dilated to the necessary size, and a speculum containing its obturator introduced into the urethra. By means of a crank the top of the table is turned on a transverse axis so that the lower end is elevated and the upper end depressed. The patient is thus made to rest on an inclined plane, being held by the shoulder supports, her trunk being flat against the table and not bent in any way, so that her respiration is free and the anesthetic easily administered. The writer usually raises the table-top until its lower end is eighteen to twenty-two inches above the normal level. The obturator is then removed from the speculum, allowing air to enter and dilate the bladder. The examination of the bladder and ureters is then carried out, the examiner standing on a stool so that the eyes may be well above the outer end of the speculum.

This posture has all the advantages of the genupectoral position and none

of its disadvantages. In difficult cases in which distention of the bladder has not been thoroughly satisfactory I have not been able to get better results by trying the genupectoral position. The method is also advantageous in the cases in which examinations of the bladder or catheterization of the ureters is to be followed by operation. The table is merely lowered and the procedure at once begun if the vaginal route is to be chosen.

Anesthesia.—A general anesthetic is advisable when the examination may be prolonged or may be followed by therapeutic procedures, *e. g.*, scraping, burning, etc., also when the urethra is sensitive or the patient nervous. In many cases it is sufficient to apply cocain (5 to 10 per cent. solution) to the urethral mucosa five minutes before the examination by means of cotton wrapped around an applicator. Frequently no anesthetic of any kind is needed.

Technic.—Before dilation the size of the urethra may be measured with a calibrator—an elongated metal cone. Dilation may be carried out with the ordinary graduated instruments used to dilate the cervix, though Kelly employs the calibrator for this purpose. The instruments should be lubricated with boroglycerin. Vaseline may cause a film which may be mistaken for pus.

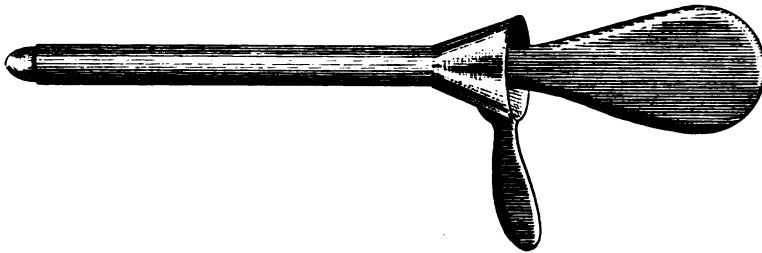


Fig. 92.—Kelly's cystoscope.

The external urethral orifice causes most resistance, and sometimes may be fissured in obtaining the necessary enlargement. Very rarely is there a tear of such importance as to require a suture at the end of the examination. In girls and old women it is not advisable to employ the degrees of dilation which may be safely employed in young adults. A very tough orifice may be incised and afterward sutured.

For ordinary examination purposes it is rarely necessary to enlarge the urethra more than is sufficient to admit a speculum 12 mm. in diameter. In carrying out therapeutic measures it may be necessary to use a larger size.

Instruments are made as large as 20 mm. in diameter, but the author has never found it necessary to use one above 15 mm. After the age of fifty and in young girls it is not advisable to use sizes larger than 10 mm. In parous women no dilation may be necessary in some cases. The *speculum* used by Kelly is made of nickel-plated metal. It is cylindric, the outer end being funnel-shaped, the whole length being about $4\frac{1}{4}$ inches. A handle 3 inches long is attached to the funnel end. This instrument is made in numbers ranging from 5 to 20, representing the diameter of the cylinder in millimeters. Each has a metal obturator which fits into the speculum

so as to fill the inner end with a bullet-shaped bulb, in order to prevent injury of the urethral or vesical mucosa during the introduction of the instrument. When the table is elevated and the obturator is removed from the speculum, strong sunlight or an electric light should be reflected into the bladder by an ordinary concave mirror attached to the forehead. Instead of this arrangement, an electric light inclosed in a cylinder with a convex lens, and communicating with a storage battery (or with the house electric system, a proper rheostat being used), may be placed on the forehead so as to illuminate the bladder directly. (Some prefer a speculum which allows a small glass-inclosed electric light to be passed down a groove on the inner surface of the tube as far as its inner end, which is beveled. The light is derived from a dry-cell battery. This method is convenient, but it is difficult to keep the small lamps and battery in good order. The author has found it of chief value in demonstrating intravesical conditions to students.)

By moving the handle of the speculum almost the entire inner surface of the bladder may be inspected. During the examination the urine which escapes from the ureters trickles to the most dependent portion of the bladder. It may be removed as desired by means of a rubber tube attached to a syringe or aspirating bottle. It is an advantage if a short round nozzle with perfora-



Fig. 93.—Vesical probe or searcher.

tions is fastened to the end of the tube which enters the bladder, for it removes the risk of sucking the mucosa into the tube.

Bleeding areas may be swabbed with portions of sterile cotton wrapped on flexible wire applicators or introduced with long slender mouse-toothed forceps.

Kelly has devised a useful instrument termed by him a *searcher*. It is a slender steel rod seven inches long, with a small bulb at one end and a handle at the other, set at an angle of 120 degrees. Its chief value is in locating the ureteral orifices in doubtful cases, but it may also serve as a sound or probe in the bladder.

Appearance of the Interior of the Air-distended Bladder.—The inner surface appears smooth and glistening, and has a dull white color, somewhat like that of an aponeurotic membrane. Slight elevations and depressions may often be seen, due to variations in the thickness of the musculature. Everywhere branching and anastomosing vessels are seen in the mucosa. Over the trigone they are distributed in a somewhat fan-shaped fashion, running from the internal urethral orifice toward the ureters, beyond which they run to the sides of the bladder. These are derived from the inferior vesical vessels.

Elsewhere groups of branching vessels are mostly found, irregularly distributed and derived from the superior vesical vessels over the superior and

lateral areas, and from the middle vesical over the posterior area related to the cervix and upper vagina. The vessels of the trigone are more numerous than in other portions, causing it to appear more congested than the rest of the bladder.

It is important to note that these appearances in the normal bladder are different from those presented in the undistended condition. In the latter the mucosa is of a uniform rosy hue, owing to the filling of abundant capillaries. Air dilation obliterates so many of these small vessels that the mucosa appears white. The least change occurs at the trigone, where the mucosa is not movable and cannot be much stretched. Occasionally, on examining a bladder, changes in color may be seen if the wall does not remain in one position, but varies in the degree of stretching. Sometimes, on removing the obturator from the speculum, the mucosa may be drawn into the latter by suction. This portion becomes hyperemic and may easily be mistaken for a catarrhal patch. A similar appearance may be caused by the suction of urine through a tube if the mucosa be caught.

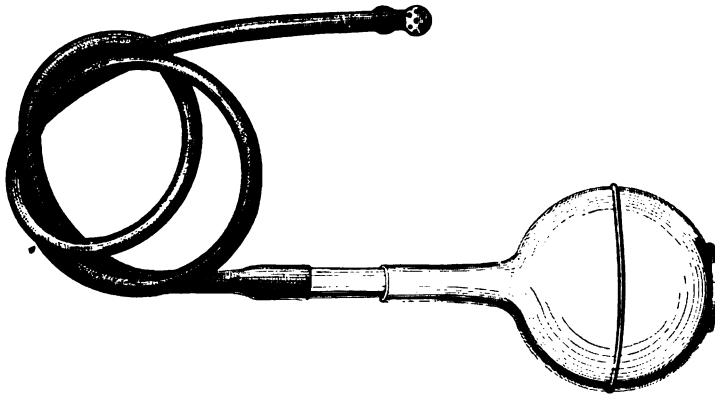


Fig. 94.—Suction apparatus (three-fourths natural size), used for withdrawing residual urine (Kelly).

To find the ureters, the slight transverse elevation of the interureteric ligament should first be sought. The end of the speculum should then be turned outward, first on one side and then on the other. The ureteric orifice varies in appearance. It is usually found on a slight elevation, the *mons ureteris*, and appears as a transverse line about 2 mm. in length. It often resembles a fine water-line on writing-paper, as was pointed out by Kelly. Sometimes the orifice is like a small dimple, pit, or crater. External to it is usually a pale inner zone and a congested outer area, the latter being formed by the trigonal vessels running outward. The urine may be seen to escape from the ureters at intervals in little jets. This phenomenon may be better studied if some dark coloring-matter has been previously administered to the patient. Voelcker and Joseph have recently advised injecting into the gluteal muscles 4 c.c. of a sterile solution of indigo-carmin thirty minutes before examining the bladder (0.4 gm. of indigo-carmin in 10 c.c. of normal salt solution). Fischer uses methylene-blue for the purpose. It may be given internally (0.2 gm. in capsule) previous to examination, or subcutaneously

(0.05 gm. in aqueous solution). Sometimes, by holding the end of the speculum close to the ureter, a few drops of urine may be collected and withdrawn by a piece of cotton or by a narrow pipet. This should be attempted when there is an infective process in the bladder which might make it risky to introduce a catheter into the ureter.

Catheterization of the Ureters.—Occasionally it is necessary to introduce catheters or bougies into the ureter in the investigation of various diseased conditions, *e. g.*, stricture or calculus in the ureter, hydroureter, pyoureter, in obtaining information regarding the condition of the kidneys, and in irrigating the pelvis of the kidney.

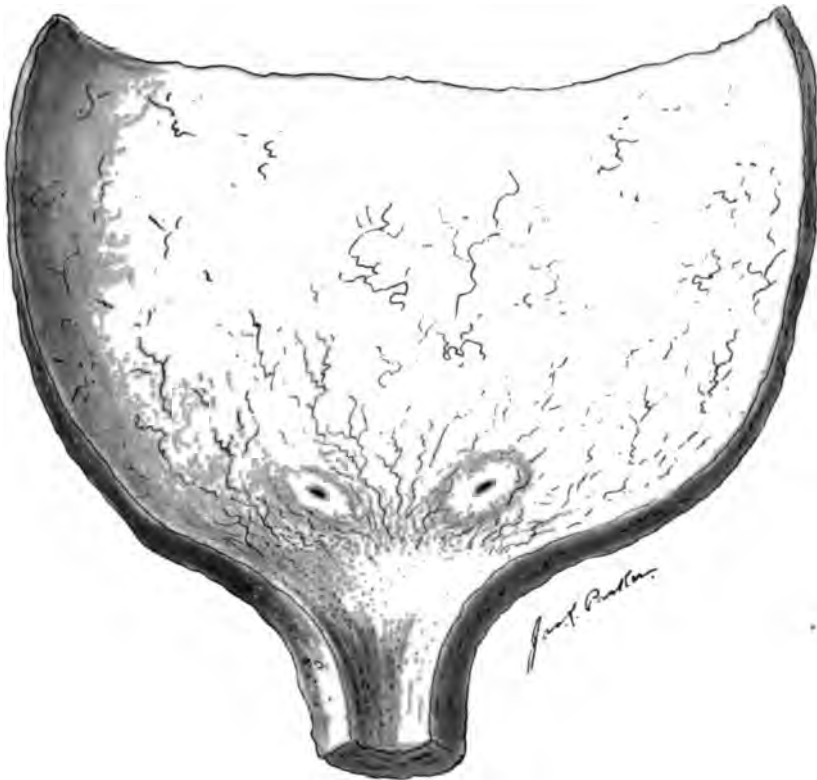


Fig. 95.—Basal portion of mucosa of bladder, showing ureteric orifices.

Two varieties of catheter are employed—rigid and flexible. The former is made of polished metal and is meant to be inserted into the ureter only for a short distance. Kelly also employs special graduated metal catheters in dilating ureteral strictures near the bladder.

Flexible catheters made of woven silk coated with varnish are most frequently employed. They are made in various lengths and sizes, some being long enough to reach the renal pelvis. Each one is furnished with a wire stilet to give a certain degree of stiffness during introduction. Reynolds, of Boston, has introduced a flexible catheter made of block-tin, and the

author has made one of spirally twisted silver wire. Kelly uses bougies of hard rubber. They may also be made of woven silk, coated with varnish. The latter are less liable to break.

Introduction of the Catheter.—The ureteral orifice is found in the manner above described, and the speculum held opposite it. The catheter (having been previously sterilized) is held in the right hand, its end being dipped in boroglycerin as a lubricator, and it is passed through the speculum into the ureteral orifice and pushed carefully upward as far as is deemed necessary. If there is any inflammation in the bladder, the ureteral orifice and interior of the end of the speculum should be carefully swabbed out with cotton soaked in a solution of formalin (8 drops to a pint) to diminish the risk of carrying infection up the ureter. It is always advisable to cover the hand with a sterile rubber glove before the catheter or bougie is touched. When the long catheter containing a stilet is used, an assistant withdraws

the wire as the catheter passes up the ureter; frequently this instrument may be sufficiently rigid to pass without the employment of any stilet.

When the other ureter is to be catheterized at the same time, in order that both catheters may be left in position for the purpose of collecting the urine from the kidneys separately, the speculum is withdrawn and reintroduced alongside the catheter already introduced. The ureteral orifice is located, and the second catheter inserted in the same manner.

Collection of the Separate Urines.—The most satisfactory manner of obtaining the urine from each kidney is by the use of two catheters introduced into the ureters, as described above. When the speculum is withdrawn, the ends of the catheters to the extent of several inches protrude from the urethra.

Each of these should then be placed in a test-

tube or bottle whose neck is well filled with cotton to absorb any fluid that might run down the outside of the catheter. The bottles should be marked "right" and "left," so that there may be no mistake as regards the identity of the specimen. The tubes or bottles may be placed in holes in a block of wood, so that they may be firmly held during the collection of the urine.

The patient lies flat on her back in bed, until a sufficient quantity of urine flows into the tubes. This may require a period of one or more hours. The catheters are then withdrawn.

The urines may be collected separately in another manner. One catheter is placed in a ureter in the manner described. The bladder is then thoroughly emptied by the suction apparatus and cotton swabs. The patient is then placed on her back in bed, the catheter draining into a vessel. After an hour or more the urine which has collected in the bladder may be removed with a glass catheter; it represents the output of the free ureter. The ureteral catheter is then removed.

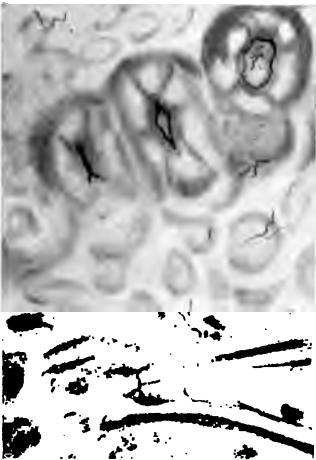


Fig. 96.—Loculate mucosa of bladder.

Various instruments termed *segregators* have also been devised for the purpose of obtaining a specimen of urine from each side of the bladder, without ureteral catheterization. They are not so satisfactory as the methods already described.

Examination of the Urethral Wall—Urethroscopy.—The urethra may be examined through the ordinary vesical speculum, as the latter is slowly withdrawn. Grünfeld has termed the endoscopic picture a flat funnel. Near the bladder the opening is quite large; as the speculum is drawn out it diminishes, the walls approaching over the end of the speculum. Toward the outer part of the urethra the lumen forms a transverse slit, which becomes vertical at the orifice. The wall is rosy pink, the striations caused by the longitudinal mucosal folds. Kelly states that these are crossed by a transverse fold in the outer part of the urethra.

Examination in the Genupectoral Posture.—H. Kelly is a strong advocate of the knee-chest posture. The author considers it inferior to the elevated lithotomy posture described previously, and employs it only when there is no table suitable for obtaining the other. When the patient is in the genupectoral position, the operator has to work in an inconvenient attitude; if a general anesthetic is employed, its administration may be difficult and hazardous on account of the twisting of the patient's neck. When the elevated lithotomy posture is used, the examiner stands at ease, the patient rests comfortably, an anesthetic may be given satisfactorily, and *the exploration of the bladder and ureters is much more easily carried out than when the genupectoral posture is employed.*

(g) **Examination of the Bladder Distended with Water by Means of an Electric Cystoscope.**—This method was introduced by Leiter, of Vienna. In his instrument the electric light was conducted into the bladder by refracting prisms at the outer end of the cystoscope. Nitze made an important advance in 1876, when he placed a vacuum lamp at the inner end of the tube, which illuminated the bladder through a window on the anterior surface of the tube, a series of lenses being arranged so as to transmit to the eye a magnified image. The electric current is carried to the lamp by insulated wires. This instrument has been variously modified in recent years, the later forms being adapted to ureteral catheterization. For the latter purpose two types of cystoscopes are employed, viz., those giving an indirect and enlarged image, and those giving a direct and enlarged image. Instruments giving the indirect image are modifications of the Nitze cystoscope. In these there is a tunnel on the upper surface, through which a catheter may be passed; it emerges in front of the window under which the prism is placed. Various mechanisms are employed for directing the tip of the catheter. Some instruments are single-barreled, permitting the passage of one catheter only; others are double-barreled, allowing two catheters to be introduced into the ureters without withdrawing the instrument.

Instruments which give a direct image are based upon the ideas first put forward by Brenner. The under surface is channeled for the passage of the ureteral catheter. Modifications have been introduced by Tilden Brown, Snell, Kölscher and Schmidt. The form devised by the two latter authorities is one of the best, being of convenient size, and allowing both ureters to be catheterized at one sitting, the catheters being left in position while the instru-

ment is withdrawn. It also permits the use of catheters with an injection attachment.

Use of the Electric Cystoscope.—The patient is placed in the lithotomy posture. The bladder is filled as full as possible with sterile water or normal saline solution without causing the patient discomfort. If the urine is not clear, it is advisable to irrigate the bladder for a time before filling the viscus.

In sensitive patients some authorities advise the use of a solution of cocain in the urethra or bladder beforehand. This is of uncertain value, however, and may be a source of risk. Köllischer and Schmidt prefer to use morphin, placing a suppository in the rectum ten minutes before examination. General anesthesia may, however, be necessary when the patient is very sensitive to the manipulations. In the case of an infected bladder they recommend preliminary flushing out with a nonirritating silver solution, this being repeated at the end of the examination. The instrument should be tested before its introduction, to determine that it is in good order. It is lubricated with sterile glycerin.

Alleged Advantages of this Method.—It may be used without much unpleasant posturing of the patient. It is equally applicable to the male and female. General anesthesia is rarely necessary. Double-barreled instruments permit of catheterization of both ureters without withdrawal.

Comparison with the Method of Cystoscopy after Postural Air-distention of the Bladder.—While the author admits that the water method is the only one which is suitable to the male, he regards it as inferior to the air method (as described on p. 169) in the examination of the female. In carrying out the latter he has never known a sensible woman to be inconvenienced by the elevated lithotomy (or even the genupectoral) posture. General anesthesia is rarely necessary. Specula of large size are not needed by an expert. The small percentage of cases in which complete distention cannot be obtained is no greater than that in which the fluid method fails. Moreover, slight or partial distention never interferes with the examination of the base of the bladder, at least, with the air method, whereas when the other procedure is employed, it may be entirely insufficient.

It is frequently advisable to examine the bladder when a vesicovaginal fistula is present. In this condition the air method can alone be used. When the urethral musculature is weakened or torn, it may be impossible for the bladder to retain sufficient fluid to permit of the use of the Nitze instrument. The air method permits various procedures to be carried out through the short speculum, *e. g.*, removal of foreign bodies, cauterization, curetage, etc.

VAGINAL SPECULA.

As has already been pointed out, we have a means of examining the walls of the vagina and the vaginal portion of the cervix without the aid of instruments. If a woman be placed in the genupectoral position, or in the lithotomy posture with her pelvis elevated, and if the introitus vaginae be then opened with the fingers, the air balloons the vagina, and by means of a good light we can inspect the cavity thus formed. Had the physics of the abdomen and pelvis been known centuries ago, the history of the speculum would have been different from what it is. Moreover, had the normal condition of the vagina

been known long ago, there would not have been so many imperfect instruments made. It is only recently that the vagina was found to be a mere slit in the pelvic floor, and not the large cavity figured in the old books. The exact length of the canal, also, has only been rightly known for a few years. For centuries it was described as being several inches longer than it really is, and the instruments were made accordingly.

The history of the speculum is interesting, but a detailed account scarcely falls within the limits of a practical work. The instrument was used among the Greeks and Romans by Hippocrates, Soranus, Paulus, and others. Specimens may be seen in Pompeii.

In later times it was employed by Ambrose Parè, Paracelsus, and many others. All the ancient forms were valvular or tubular, the latter being either funnel-shaped or cylindric. The oldest forms were valvular; they possessed two, three, or more blades. For a considerable period before the time of Récamier, the speculum had largely fallen into disuse. This distinguished Frenchman reintroduced the instrument as an aid in diagnosis. His speculum was funnel-shaped, seven inches in length, and made of tin. It is to Marion Sims that we are indebted for the spatular form of speculum, which was introduced by him as a means merely of opening the introitus vaginae while the patient was in the genupectoral position, in order that the air might rush in between the vaginal walls and distend them. Most text-books, at the present time, describe the three chief varieties of speculum, namely, tubular, valvular, and spatular; giving equal prominence to each. For practical purposes all except the spatular variety may be abolished.

Spatular Speculum.—The classic instrument is that of Marion Sims. It consists of a handle with a duck-bill blade at each end at right angles to the handle. The blades are of unequal size. It is really a double speculum, and is made of polished metal. In Bozeman's modification of this instrument the blades join the handle at a somewhat acute angle.

Though at first Sims got the idea of this instrument while examining a patient in the genupectoral position, he afterward used the instrument to the same advantage when the patient was placed in the modified genupectoral, or, as it is generally called, the Sims' position. For many years the speculum has been used in connection with this posture, both for diagnosis and for treatment.

Use of the Sims' Speculum.—(a) In the Sims' position. The patient is placed semiprone. She lies on her left side on a couch or table, her left arm hanging over the edge next to the physician; she then turns the upper part of the body so that the breasts touch the table; her knees are drawn up and the right one made to touch the table with its inner surface. It is evident that the transverse diameter of the pelvis is oblique to the table, and that the pelvis is on a higher level than the upper part of the abdomen.

The speculum is now introduced. The blade to be used is warmed and oiled on its convex surface, the instrument being held by the opposite end in the left hand. Two fingers of the right hand are passed into the vagina to open it. The blade is passed between them and directed upward and backward toward the hollow of the sacrum, until the end lies in the posterior fornix, the fingers of the right hand being withdrawn. The perineum is now drawn well back, and the upper end of the blade can be manipulated so as to move the cervix backward or forward. The opening of the vagina has led to the

inrush of air, ballooning occurs, and the cavity can be examined with a good light. To hold the instrument steady, the left hand should be placed under the handle, its ulnar surface resting on the right buttock, the handle being held between the thumb and forefinger. By keeping the outer blade on a higher level than the inner, the right labium can be raised somewhat, so that the entrance to the vagina is made more gaping.

The inner surface of the labia—the surface of the vagina except the posterior part—and the vaginal portion of the cervix can now be examined. If necessary, for better admission of light, the labia may be held aside, or a retractor used to pull forward the tissues of the pubic segment.

In this position, by shortening the length of blade in the vagina, the uterus may be pulled down by means of a volsella. A sound may be passed into the uterine cavity, applications made to it, to the cervix, or to the vaginal wall.

Until recently this position has been largely employed for the performance of several operations on the cervix, anterior vaginal wall, and base of bladder. It will, however, be found that it is most convenient to do almost all these operations in the lithotomy position. The Sims' position is, therefore, becoming much less frequently employed.



Fig. 97.—Sims' speculum.

(b) In the lithotomy position. The Sims' speculum may be used in this position, but, of course, only as a spatula, not in the same relationship as that which exists in the genupectoral or modified genupectoral. It may be used advantageously in the lithotomy position, but far more convenient for most purposes is the spatular speculum of Simon.

Simon's Set of Spatular Specula.—By far the most convenient series of specula, both for examination and operative purposes, is some such form as that devised by Simon. It consists of two handles, into which may be fitted a set of spatular blades varying in length and width. Some of these are concave, others are almost flat. One handle is used for the posterior wall, the other can be used with a retractor-like blade for the anterior wall. The blades are arranged to suit vaginae of different sizes. In operative procedures the greatest advantage can be obtained with little trouble. For operations in which we want the introitus kept as wide as possible and the uterus pulled well down,—*e. g.*, in amputation of the cervix,—the short broad blade which fits the handle at an acute angle is most advantageous, a long narrow blade in such a case being most unsuitable. Blades may also be obtained with wide lateral flanges which protect the labia. A hollow anterior blade is used by some in operations for the purpose of irrigating the parts with an antiseptic lotion, a rubber tube from a reservoir being fastened to a tap on the blade.

The Simon instrument is meant to be used in the lithotomy position, and it is evident that besides its great value in operative work, it is most valuable in examination. The combined use of two blades enables the physician to inspect the vaginal portion of the cervix and the vaginal wall. In operating,

it is sometimes helpful to use retractors as well, for the purpose of drawing the labia further apart. Ordinary copper retractors suffice for this purpose.

It is also evident that a handle, with one of the concave blades, may be used in place of a Sims' speculum if it be desirable to examine a woman in the genupectoral or modified genupectoral position.

Some of the procedures for which this instrument may be used other than for examination are the following: Packing the vagina, making applications to the endometrium, to the cervix, and to the vaginal wall; operations on the vaginal wall, on the base of the bladder, on the cervix; curetting, removing of polyps, ligation of uterine arteries, extirpation of the uterus, colpotomy.

A weighted posterior retractor may be used in operative work to great advantage, since it does not require to be held by an assistant.

Tubular Speculum.—This is made of various materials, *e. g.*, celluloid, metal, wood, glass, vulcanite. The one most commonly employed is the Fergusson speculum. It is a cylindric tube with one end trumpet-shaped and the other beveled. Owing to the beveling one side is longer than the other, so as to suit the anterior and posterior vaginal wall. Several sizes of this instrument are used.

This speculum is passed ordinarily when the patient lies in the lateral position, but it may be used in the lithotomy. When it is introduced, the cervix should lie in the upper end.

Such a speculum is of very little use. Through it the vaginal portion of the cervix only can be seen. No operations can be performed with it save pricking Nabothian follicles. Practically, it serves only to make applications to the vaginal portion of the cervix, and to the lower portion of the cervical canal in certain cases. A sound cannot be passed into the uterine cavity through this speculum without difficulty, and, indeed, it should not be attempted.

I have used it to advantage in making applications to the vaginal wall, in the following manner: The speculum is introduced. Through it a pledget of cotton, soaked in the fluid to be applied, is passed up to the cervix by means of a pair of long forceps. The speculum is now gradually withdrawn, the pledget following it. In this way the vaginal wall closes on the cotton from above downward and so is touched by the medicinal fluid.

Unless care be taken, the tubular speculum may give a wrong impression as to the condition of the cervix. When it is in position it may bring the flaps of a split cervix together so as to hide the lesion. The ordinary long instrument, by being pushed well up into the fornix, may give a false impression as to the length of the cervix—it may cause it to appear to be elongated.



Fig. 98.—Garrigues' weighted speculum.

Valvular Speculum.—Of this form there are many varieties. Perhaps the best known is Cusco's bivalve speculum. Neugebauer's and Barnes' instruments are also described in the books.

The Cusco speculum is introduced into the vagina with the blades closed. In position, they should lie against the anterior and posterior walls. By means of the attachment at the outer ends of the handles the inner ends of the blades can be separated.

The Neugebauer and Barnes instruments are introduced in the same manner. The posterior blade is passed, and then the anterior, the latter sliding along the former.

These valvular specula are of no greater value than the tubular forms. Indeed, the gynecologic specialist never employs them. The cervix may be examined by means of them, but they are of no use for operative procedures. It is important to note that they may give an entirely erroneous impression of the cervix in certain states, *e. g.*, if a cervix be lacerated, the valvular speculum when opened, by separating the flaps and causing the red mucosa of the canal to appear, may lead the physician to think that marked endocervicitis, with the formation of a catarrhal patch, exists. In the olden days it would probably have been diagnosed as an ulceration.

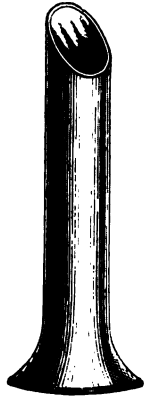


Fig. 99.—Fergusson's speculum.

Finally, in all cases, before a speculum be used, the bimanual examination should be made. For mere purposes of diagnosis, owing to the importance of this latter method, the gynecologist rarely nowadays requires to use any speculum. It is only in certain cases that it is of benefit. Its great value is in operative procedures. As an aid in diagnosis it is generally found that the instrument is most used by the practitioner who has had little experience in the special diseases of women.

THE VOLSELLA.

This instrument is used for grasping tissues during operations or in examinations. It is simply a pair of forceps. For holding the cervix an instrument eight or nine inches in length may be used. It may be straight or curved; the latter form is more easily kept out of the way of the physician when the anterior lip of the cervix is held during an operation. The blades should have a separable joint, as indeed should all forceps, in order that the instrument may easily be sterilized. Near the handle there should be a catch by which the blades can be held together when they are closed. The simplest and best form is that which is found on the well-known Pean artery forceps: it may be opened and closed without the use of two hands. The grasping teeth at the ends of the blades are two, three, or four in number, and vary in size. This instrument may be used, also, to hold tumors, to grasp the vaginal wall or external genitals in operative procedures. For most vaginal and perineal operations, however, artery forceps may be used to hold up the tissues. The most suitable form is that devised by Kocher; at its end is a sharp tooth by which the tissues are firmly held.

Ordinary bullet-forceps may also be employed for the same purposes.

A special uterine volsella may also be used for certain cases of vaginal extirpation of the uterus or for colpotomy. One blade longer than the other ends like a uterine sound, and is meant to be passed into the uterus. The other blade is like that of an ordinary volsella, and fastens into the outer surface of the cervix. This instrument gives a firm grip of the uterus, and the inner blade keeps it stiff, so that it can be better palpated and manipulated during the operation.

With the volsella the uterus, in normal conditions, may be pulled downward almost as far as the introitus vaginæ. In many pathologic conditions—*e. g.*, cellulitis and peritonitis—this is impossible. As it is pulled down it tends to become straightened and to lie in the long axis of the vagina. The vaginal wall becomes inverted, and the bladder and ampulla of the rectum somewhat drawn down.

The cervix may be seized by the volsella without or with the use of the



Fig. 100.—Cusco's vaginal speculum.

speculum. Generally the anterior lip is caught, but the other may be held if it be necessary.

(a) *Without the Use of the Speculum.*—The patient may lie in the lateral or lithotomy position. The first two fingers of the right hand are passed until the cervix is touched. The volsella, held by the left hand, is passed along these fingers and the anterior lip grasped and pulled down.

(b) *With the Speculum.*—When the vagina is opened either in the Sims', the genupectoral, or the lithotomy posture, it is a simple matter to pass the volsella and grasp the cervix.

The following are the uses of the volsella:

(a) In diagnosing the extent of a cervical laceration and judging the presence or extent of a catarrhal patch. Each flap is grasped with a volsella, and they are approximated and separated. If, when the lips are brought together, the red patch does not disappear, an endocervicitis is present, and is extending downward on to the vaginal portion of the cervix.

(b) In diagnosing the relation of the uterus to large tumors which occupy the abdominal cavity. An assistant holds the tumor, and the examiner pulls on the cervix by means of a volsella, or the latter may merely steady the instrument while the assistant pulls upward on the tumor. If the tumor be adherent to the uterus, or is a part of it, they will move together during the examination, save when the adhesions are very long or the tumor has a long pedicle. Of course, where the tumor or the uterus is fixed to other structures, their movements may be interfered with, and we may gain little information from the use of the volsella.

(c) In performing the rectal examination, we may often be greatly helped by drawing down the cervix with a volsella. The examining finger can more readily palpate—uterus, tubes, ovaries, and broad ligaments.

(d) The chief use of the instrument is in operations on the genital tract, wherever it is desired to hold a piece of tissue steady or to make traction on it, *e. g.*, in cureting, amputation of the cervix, etc.

The volsella should not be used to pull down the cervix in acute peritonitis or cellulitis, in pyosalpinx, hematosalpinx, or hydrosalpinx, in tubal gestation, in hematocele, or in advanced cancer of the cervix.

A simple tenaculum is recommended by some for the purpose of steadying the cervix. It is not so serviceable as a volsella. Such an instrument is practically only of service in vesicovaginal fistula operations.

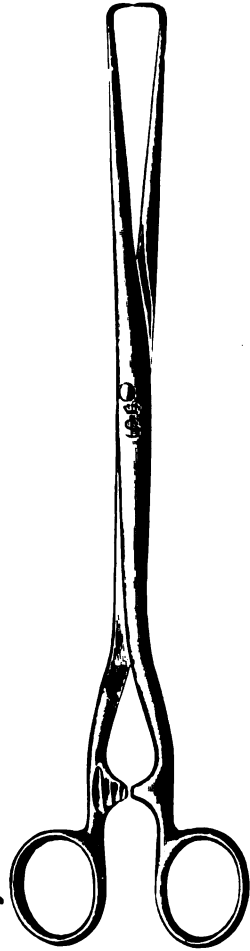


Fig. 101.—Braun's tenaculum forceps.

THE UTERINE SOUND.

In ancient times a sound was used in examining the genital tract, but it is highly probable that it was limited to the vagina. Mention is made of the instrument by Paulus Ægineta and Soranus. For a long time its use was forgotten, until it was reintroduced by Levret. It is, however, to Sir James Y. Simpson that we owe the wide use to which the sound has been put in gynecologic practice during the last fifty years. There is no doubt that the instrument has been far too extensively used; in the preantiseptic days it was often a source of infection.

But its employment in diagnosis has, during recent years, been very largely diminished, as a result of the perfected methods of examining patients by the hands alone. Indeed, in the consulting-room the sound need be used but rarely.

Many sounds have been made by gynecologists, but only one or two need be described. Any flexible metal rod with a knob-pointed end will serve as a sound. One of the best known and most serviceable is that made by Sir J.

Y. Simpson. It is about twelve inches long, and made of nickel-plated copper. It may be molded to any desired shape, yet is not too pliable. The handle has a rough and a smooth surface, the latter being on the side toward which the point of the sound looks. When the sound is *in utero*, we thus always know the direction of the point.

The end of the sound is rounded and blunt. Two and one-half inches from the end is a round knob, and at every inch beyond this there is a mark. On the old forms of this sound there was a notch one and one-half inches from the point; this is a source of weakness, and is unnecessary.

Points to be Observed before Passing the Sound.—It should not be passed during menstruation, nor during an acute attack of inflammation in the peritoneum, cellular tissue, or internal genitals, nor in a case of uterine cancer, except when there is some special reason for its use. Above all, care should be taken that the woman is not pregnant. If she has missed a period, the sound should not be passed unless it be certain that there is no ovum in the uterus. It should be employed only under the strictest technic, *i. e.*, the instrument, vulva, vagina, and the examiner's hand should be prepared as if an operation were to be performed. The ordinary routine careless use of the sound is to be strongly condemned.

A careful bimanual examination should always be made before the sound is used. The physician should gain a good idea as to the position and shape of the uterus, and should curve the instrument accordingly.

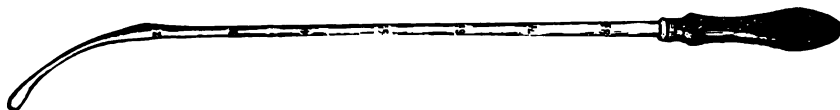


Fig. 102.—Simpson's uterine sound.

Methods of Using the Sound.—The sound may be passed when the patient is in the Sims', in the lateral, or in the lithotomy position. If she be in the Sims' posture, the cervix should be pulled down with a volsella before the instrument is introduced.

If the left lateral position is used, the following procedure is observed:

After the bimanual has been performed, the patient turns on her left side and draws up her knees. The first two fingers (or the index only) of the right hand are introduced into the vagina so that the tips touch the cervix, the palmar surface being turned toward the sacrum. The left hand holds the handle of the sound lightly, so that its rough surface is directed toward the back, and guides the point along the palmar aspect of the vaginal fingers until it enters the os uteri.

In cases where the uterus lies to the front the end of the sound is gently directed into the cervical canal for about half an inch. The handle of the instrument is next carried by a long sweep until it lies under the symphysis, its rough side directed toward the front. The handle is next simply moved backward toward the perineum. By the latter manœuver the point of the sound moves forward to the fundus of the uterus.

If the uterus be retroverted, the method is simpler. No long rotation of the handle is necessary. After the point of the sound has entered the cervical

canal, the handle is moved directly forward toward the symphysis. In this way the point of the instrument moves backward to the fundus uteri.

When the patient is in the lithotomy position, the sound is passed directly, being held according to the position of the uterus. Thus, if the uterus lie to the front, the handle is held at first in the middle line opposite the symphysis, and then moved backward; at the same time the point of the sound moves directly to the fundus.

In no case is any force to be used; the sound should merely glide into the uterus. In normal cases no pain should be caused, though often the patient has an unpleasant feeling. In nervous women, or in cases in which the canal is very narrow, there may be a feeling of colic or of sickness. No bleeding should be caused by the passage in normal conditions.

Difficulties in Passing the Sound.—The point may catch in a fold of the arbor vitæ of the cervical mucosa. It should not be forced through the obstruction, but should be withdrawn somewhat, and passed along again until it slides by the fold. Owing to marked displacement of the uterus, it may be impossible to get the sound into the os; in such a case it may be necessary to pull down the cervix with a volsella. In cases of marked ante-flexion or retroflexion it may be impossible to pass the sound around the bend; by pulling down the cervix or pushing up the fundus with the vaginal fingers (or with a finger in the rectum if the uterus be retroflexed), the difficulty may be overcome. If there be stenosis, either of the external or of the internal os, it may not be possible to pass the instrument. If the uterine cavity be tortuous, owing to the bulging of a tumor in its wall or to the presence of a polyp, it may be impossible to guide the sound through the whole length of the canal. For these last-mentioned cases a soft bougie or catheter is recommended by some; one may be deceived in their use, however, because they may curl up in the cavity and give one a false idea as to the length of the canal. When there is atresia of the uterine cavity, of course the sound cannot be passed. There are different conditions in the vagina also which make it impossible to sound the uterus, *e. g.*, narrowing, the presence of large polyps in it, etc.

Use of the Sound.—(a) *In Diagnosis.*—1. To ascertain the length of the uterine cavity. In ordinary practice this is the chief use to which the sound is put.

2. To determine the thickness of the walls of the uterus. This rarely is done. For the posterior wall, a finger is introduced into the rectum; for the anterior, it is passed into the anterior fornix, into the bladder, or against the abdominal wall.

3. To estimate the degree of patency of the uterine canal. This has special reference to the cervical portion. In the great majority of cases it is only the os externum or the os internum to which attention is paid. Atresia or stenosis may be diagnosed.

4. To ascertain the presence of tenderness in the walls of the uterus, and to detect irregularities or tumors of the inner surface. In several diseased conditions bleeding may be caused.

5. To determine the direction of the uterine axis and the relation of the body to the cervix in cases where this is impossible by means of the bimanual examination. In the great majority of cases the bimanual alone is sufficient

for the determination of the position and flexion of the uterus. But in certain cases—*e. g.*, in tumors of the uterine wall; in large, bloody, or inflammatory exudations around the uterus; in cases of small exudations, cellulitic or peritonitic; in irregular or multiple tumors of various kinds in close relationship to the uterus—the bimanual may not be able to distinguish the fundus uteri.

The sound must be passed most carefully. While it is in position the bimanual is performed, the instrument being held by the vaginal hand. The abdominal hand may feel the fundus uteri pushed upward by the end of the sound. It is for such an examination that the A. R. Simpson sound is more useful than the Sir J. Y. Simpson instrument. Owing to the length of the latter it is not easily held by the vaginal hand. The shorter A. R. Simpson sound when passed rests by its handle on the hand, where it is held by the ring and little fingers against the hypothenar eminence.

In cases of flaccid uterus it is valuable to do the bimanual while the sound is *in utero*.

6. To determine the mobility of the uterus in certain cases. The sound is rarely required for this purpose. When it is desired to make out the relation of a large tumor to the uterus, the sound may be passed and its movements noted while the tumor is moved by the other hand or by an assistant. It is never justifiable to attempt to move the uterus in order to determine the effect on the tumor. Nor is it right, in a case where there is no tumor, to move the uterus about by means of a sound. Mobility of the uterus should be determined by the bimanual examination.

(b) *In Treatment*.—1. To replace a retroverted or retroflexed uterus.

2. To dilate a stenosed uterine canal. For this purpose it is generally used along with special dilators.

3. To apply fluid to the uterine mucosa; for this purpose its end is covered with cotton.

Dangers in the Use of the Sound.—The great danger is that connected with the introduction of septic organisms, as a result of which general blood-poisoning may follow or local pelvic inflammation of various forms. The uterine wall may be perforated when it is thin, as in superinvolution; or when it is soft, as after an abortion. Severe hemorrhage may be caused sometimes, *e. g.*, when the mucosa is in a condition of hemorrhagic endometritis, or in new-growth formation in the mucosa. Another great risk is the passage of the sound in cases where the physician has failed to exclude the existence of pregnancy. The greatest caution should be exercised.

DILATORS.

Dilation of the Genital Tract.—Dilation is employed both for purposes of examination and of treatment.

(a) *Vagina*.—For purposes of examination it may sometimes be necessary to dilate the introitus or the canal itself. The following means are used:

1. Repeated tamponade of the vagina.
2. Gradual dilation with Barnes' bags.
3. The introduction of different sizes of hard-rubber or glass tubes.
4. The insertion of round or oval dilators, *e. g.*, Bozeman's.

The dilation may be continued for one, two, or more days, according to the nature of the case, and the examination should be made as soon as the dilation is completed.

In the treatment of such conditions as stenosis of the vagina, or atresia which has been opened, or in cases where more room is needed for operations on the vaginal walls, base of bladder or uterus, the canal may be dilated by one or other of these methods. In addition, however, the two following plans must be kept in mind:

5. Dilation with the hand under chloroform, the fingers being arranged as a cone. This method is used in certain forms of dyspareunia, and to gain more room in operations on the upper genital tract.

6. Incision of the perineum. This may sometimes be necessary in operations, *e. g.*, the removal of an intrauterine polyp in a nullipara. The incision should be made on each side, a short distance from the middle of the anterior margin of the perineum. The cut should extend as deeply as is necessary in a backward and outward direction. Bleeding points must be tied, and aseptic precautions observed. At the end of the operation the wounds are closed with catgut suture.

(b) *Uterine Canal*.—The uterine canal may require to be dilated both for purposes of diagnosis and of treatment, *e. g.*, where polyp, malignant disease, or remains of placenta and membranes may be suspected to exist in the uterine cavity, in stenosis of the canal, to allow passage of a curet,

or application of medicaments to the mucosa, etc.

The following methods may be employed:

1. *By the Use of a Series of Graduated Dilators*.—Hegar's instruments are very suitable. In a complete set there are thirty, measuring in diameter from $\frac{1}{12}$ to $1\frac{1}{2}$ inches. Their length should be 6 or 7 inches, and they should be made of polished metal. The form shown in Fig. 103 is very serviceable, each instrument consisting of two sizes.

Method of Use.—It is generally most convenient to anesthetize the patient, who is placed in the lithotomy position. The vagina is made thoroughly clean and the dilation is carried out with thorough aseptic technic. The position and relations are made out by means of the bimanual. The cervix is drawn down and held steady by means of a volsella or two. The size and direction of the canal are estimated with a sound, and the dilators, dipped in boroglycerin, are passed in succession until the necessary degree of dilation is reached.

There may be difficulty owing to a marked flexion of the uterus. In such

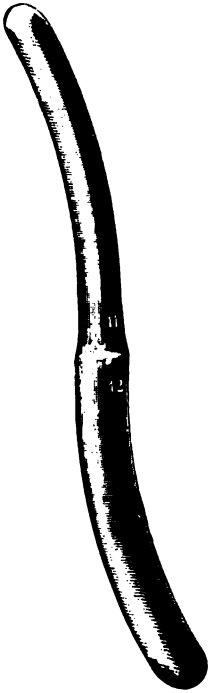


Fig. 103.—Double dilating sound.



Fig. 104.—Hegar's uterine dilator.

a case a finger placed in the anterior or posterior fornix may help] to straighten the uterus while the dilators are being passed; or special metallic curved bougies may be used. In extreme rigidity of the wall there may be difficulty in introducing the dilators. In such a case it is often advisable to use a metal instrument, like that of Sims or Goodell, along with the Hegar dilators.

In very many cases the wall of the uterus is not torn by these manipulations, but sometimes it is, especially at the internal or external os.

After dilation is completed and the examination finished, the canal is washed out with an antiseptic.

In certain conditions of the uterus the finger may be introduced into the uterus without preliminary dilation, namely, after an abortion or full-time labor; or after a polyp has passed through the cervical canal.

2. *By the Use of Steel Dilators with Separable Blades.*—Sims' and Goodell's instruments are very serviceable if made of good metal. The former has three blades, the latter two.

Method of Use.—The patient is arranged as before described. The dilator is passed, with closed blades, through the cervical canal, and then either the screw at the end of the handles is turned, whereby the blades separate slowly and dilate the cervix, or the hands may press the handles together, whereby more forcible dilation is caused. If the dilator will not enter the canal it is necessary to pass several small Hegar bougies, in order to enlarge the passage sufficiently. It is best not to attempt great dilation with this instrument. It should only be used for moderate degrees.

3. *Enlargement of the cervical canal* may sometimes require to be brought about by means of cutting operations. These will be described later (see p. 463).

4. *By the Use of Tents.*—Formerly tents were largely employed in gynecologic practice. Now they are but rarely required. The author has entirely abandoned them. Three varieties are employed, namely, sponge, tangle, and tupelo tents.

Sponge Tent.—The sponge tent is an elongated, cone-shaped piece of dried, compressed sponge, impregnated with an antiseptic. When introduced into the uterus it stimulates the mucosa to secrete, and the fluid soaking into the sponge causes it to expand, and so to dilate the canal. Before it is used it may be immersed in a concentrated alcoholic solution of phenol, or in a saturated solution of iodoform in ether, with a little alcohol. Then it may be rapidly scrubbed in 1:500 corrosive solution. Each one is provided with a string by means of which it may be pulled out of the cervix after use.

Method of Use.—The patient is placed in the lateral, in the Sims', or in the lithotomy posture, and the genital tract thoroughly cleansed with an antiseptic lotion. A speculum can be used to expose the cervix, which is pulled down with a volsella. The tent is then passed into the

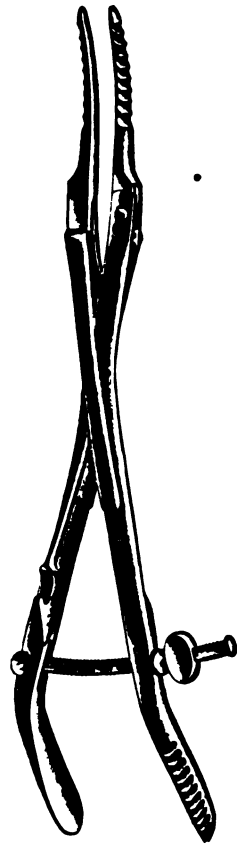


Fig. 105.—Goodell's uterine dilator.

cervical canal by means of the fingers or a pair of curved dressing-forceps; special tent-introducers are not necessary. In some cases no speculum need be used. In other cases where one lacks assistance the tent may be introduced while one hand steadies the fundus through the abdominal wall.

When the tent is in position, its base should remain outside the os externum. It should be held in the cervix for a little. If it shows no tendency to slip out, no vaginal plug is necessary. If it tends to move, an antiseptic tampon should be introduced. The tent should not be left in the cervix longer than twelve hours. During the process of dilation an occasional antiseptic douche should be given, and after dilation the douche should be repeated. If necessary, another and a larger tent can be introduced. The tent is removed by gentle oscillatory traction on the string. Care should be taken that no piece is torn off and left behind in the uterus.

Tangle Tent.—This is made of the stem of the sea-tangle (*Laminaria digitata*). It may be solid or perforated. The latter expands more rapidly than the solid form, but is not so effective. This tent may be impregnated with an antiseptic, because if dried after soaking it will get smaller again, though it may somewhat lose its rounded shape. It may, however, be smoothed. Before its introduction it may be softened in a hot antiseptic, and bent to the curve of the uterine canal. If placed in a cold lotion for a little, it retains this form. If necessary, several small tents, bound together by a rubber band, may be introduced into the cervix instead of a single one. Tangle dilates least rapidly of the three forms.

It is introduced in the manner described for the sponge tent. It tends to slip out unless kept in position by a vaginal tampon.

Tupelo Tent.—This is made of the root of the *Nyssa aquatilis*. It cannot be soaked with an antiseptic, because if once expanded, it will not return to its original size. It dilates rapidly when in position, but not to so marked a degree as the sponge tent.

Dangers Connected with the Use of Tents.—All tents are dangerous because of the risk of introducing septic material. The most dangerous is the sponge tent, because it tends most of all to injure the mucous membrane, and to produce a profuse secretion which may collect and decompose; it is difficult to cleanse it thoroughly; a part of it may be torn off and left in the uterus, when its removal is difficult, owing to the contraction of the uterus on it. Tangle and tupelo tents are much safer.

Points to be Observed with Regard to their Use.—A tent should only be used once. Not more than two should be introduced in succession. The patient must remain in bed during and after their use. They must be introduced under strict aseptic precautions. While in position the vagina should be douched every three or four hours. Tents are not to be used in acute inflammation in the pelvis, nor



Fig. 106. — Sims' uterine dilator.

when blood extravasations, cancer of the cervix, or distended Fallopian tubes are present.

THE CURET.

This instrument was first employed by Récamier in 1846. It is used in scraping the endometrium for diagnostic purposes (*i. e.*, for the examination of the tissue removed), and also for treatment.

Various forms of curet are in use. The following need only be described: Roux's, Simon's, and Récamier's. Roux's has an elongated, hollowed-out portion, with sharp edges at each end of a handle, one of which is larger than the other; it is made of steel. The ends should be rounded, not pointed. Simon's curet has a round, spoon-shaped end, with sharp edges. Récamier's instrument has a loop end, one end of which is sharpened.

Dull wire curets have been used, but they are quite unnecessary. Perforated spoon curets are used by some; they allow a stream of antiseptic lotion to irrigate the uterine cavity during the cureting.

Method of Using the Curet.—The patient, with empty bladder and rectum, is placed in the lithotomy position (some use the Sims' position). A careful bimanual examination is performed. The vulva and vagina are thoroughly cleansed. Anesthesia is advisable, though without it the operation may sometimes be performed without causing pain.

A short-bladed spatular speculum is introduced posteriorly and held by an assistant. The cervix is drawn down by a volsella placed in the anterior lip; the handle is held by the assistant over the symphysis. A sound is next passed to estimate the size and direction of the uterine cavity. If the cervical canal is large enough to admit the curet quite easily, no dilation is necessary. If it be not, Hegar's dilators or an expanding dilator may be used. The cavity is next washed out by means of a double catheter. Then the curet is introduced as far as the fundus. If the whole endometrium is to be scraped, the operation should be done in a systematic fashion, *i. e.*, the anterior wall should first be attended to, then the posterior, then the fundus, and, finally, the lateral borders.

Unless such a methodic process be adopted, some parts of the mucosa are apt to be left untouched.

In scraping, the forefinger of the left hand should be placed in the fornices against the uterus, and it should be moved about so that the instrument always works against it.

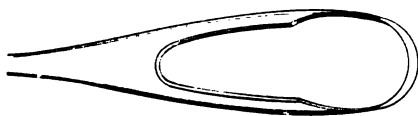


Fig. 107.—Loop of Récamier's curet.



Fig. 108.—Distal end of Roux's curet; actual size (Ashton).

When a scraping is to be made for examination, only the part desired need be removed. If there be endocervicitis around the os externum, the diseased part may also be scraped off. In many cases, as the curet touches the muscular wall, a grating sound is made. The same sound is produced if dense new-growths are present; also when the curet scrapes the folds of the cervical mucosa in certain cases of hyperplastic endocervicitis.

All débris is now washed out of the uterus and vagina with a hot antiseptic lotion. Formalin or some other antiseptic styptic is then applied to the raw surface, an antiseptic tampon is placed in the vagina, and the patient is put to bed. In cases where the uterus is soft or hemorrhage is feared, an antiseptic tampon, *e. g.*, chinosol gauze, may be placed in the uterus.

After-treatment.—The vaginal tampon is removed on the day following the operation, and an antiseptic douche given. This is continued twice a day for a week; thereafter once daily as long as may be required. The patient may get out of bed at the end of eight or nine days, save after abortions, and in cases where it may be necessary for other reasons to keep her at rest. She must only gradually return to her duties.

Conditions in which the Curet is Employed.—In inflammatory conditions of the uterine mucosa; in incomplete abortion; in adenoma, sarcoma, and carcinoma of the mucosa; in conditions of the mucosa whose diagnosis is uncertain.

In the great majority of cases Roux's curet will be found to be the most serviceable. In abortion cases, or in sarcoma or adenoma cases, where large masses are to be removed quickly, a large Simon curet is, perhaps, the most convenient.

Contraindications.—Pregnancy, acute inflammatory conditions in the pelvis, distended Fallopian tubes. Formerly chronic inflammation in the pelvis was mentioned as a contraindication, but this belief must be abandoned. Cureting is not risky in these cases if a strict technic be observed.

Moreover, the cureting may benefit the chronic condition by removing what is so often an area of germ infection, namely, the diseased mucosa of the uterus. In regard to acute inflammations, it must be noted that if they occur in the puerperium, they may be related to diseased conditions in the interior of the uterus, and in certain of these cases it is recognized that cureting is not only justifiable, but absolutely necessary.

Dangers.—The dangers of cureting are the introduction of septic infection, perforation of the uterus, causation of hemorrhage.

Antisepsis must be thoroughly carried out. The instrument should be handled carefully. Perforation is most apt to occur when the uterine wall is soft, as after an abortion, or as a result of the infiltration of a rapidly growing sarcoma, or when it is abnormally thin.

In the majority of cases there is little loss of blood during or after cureting. It may be considerable, however, in hemorrhagic or fungous endometritis, in incomplete abortion, or in malignant disease. For such cases the uterine tampon of antiseptic gauze for a day or two is most valuable.

THE ASPIRATOR.

In gynecologic practice the aspirator is employed both for purposes of diagnosis and of treatment. Its main use is for the latter.

1. In the examination of women, in the majority of cases, we are able as a result of the clinical history and of careful physical examination (especially under an anesthetic) to ascertain the presence of fluid, and to have a fairly correct idea as to its nature. Still there are certain conditions in which, owing to our uncertainty regarding these points, we may desire to employ the aspiratory needle.

The swelling may be punctured through the vagina or through the abdominal wall. The instrument must be used under the most careful aseptic precautions. In some cases an ordinary hypodermatic needle may suffice. In other cases a small aspirator with a long needle is required. The larger aspirators used in treatment are not necessary for the exploratory puncture.

2. Various forms of aspirators are used in treatment. These will be described in connection with the operations in which they are used.

CHAPTER VI.

MINOR THERAPEUTIC MEASURES.

THE VAGINAL DOUCHE.

This valuable therapeutic agency has been employed for centuries. In the time of Hippocrates it was employed merely to apply certain medicaments to the vaginal walls. It was first employed for the purpose for which it is mainly used nowadays in the fifteenth century.

Nature of Apparatus.—The best form of douche apparatus is one which allows of the flow of a continuous stream of water, under the influence of gravity. The ordinary douche-can, with rubber tube attached, is the most convenient instrument. According to the elevation of the can above the patient, the force of the stream varies. The can may be obtained in various sizes. The tube is furnished with a stop-cock, and should have at its end a vaginal nozzle, five or six inches long, with lateral perforations near the distal end. This nozzle may be straight or curved, and should be made of strong glass, so that it may be sterilized by boiling. Instead of the douche, a tube may be used with an ordinary pitcher, the flow being obtained by siphon action.

A less convenient instrument is the largely used rubber syringe worked by means of a bulb. This allows of only an intermittent stream; it is apt to fatigue the hand of the person who works the bulb, and is liable to get out of order.

Method of Use.—The douche may be taken by the patient herself, or may be given by a nurse or other person. The most thorough method is to place the patient in the dorsal position with a large bed-pan under her hips. The can, filled with the necessary lotion, is placed at a suitable distance above the patient, on a shelf, hung on a nail, or held by some one; the stream is started, and the nozzle, thoroughly clean, is passed into the vagina as far as the cervix; the water which escapes from the vagina enters the bed-pan.

If the patient has no assistance, it is usual for her to use the douche sitting astride of a vessel. This position is not so satisfactory, the fluid escaping too rapidly from the vagina. The lithotomy position is a convenient one, but is rarely necessary.

When the douche is used, there must be room enough for a good return outflow, otherwise there is danger of fluid being forced into the uterus and Fallopian tubes. Where the vagina is not roomy, a large double catheter may be used. The patient should lie at rest for fifteen minutes or more after the douche.

Indications for Use.—To remove secretions from the vagina; during the healing of wounds, *e. g.*, after operations on the cervix or vaginal walls; to apply astringent, antiseptic, and anodyne agents; to get the benefit of the thermal property of the stream.

Nature of Fluids Used.—In cases where the influence of heat is not

wanted, the fluid need only be warm. When the hot douche is to be taken the temperature of the fluid should be somewhere between 100° and 120° F.; it is best that the patient should begin with the lower temperature and gradually increase it. Ordinarily the patient is told to use water as hot as the hand will bear. Cold douches need not be employed.

Various medicaments are used in certain cases, according to the nature of the disease, *e. g.*, alum (1 dr. to 1 pint), copper sulphate ($\frac{1}{2}$ dr. to 1 pint), zinc sulphate ($\frac{1}{2}$ dr. to 1 pint), corrosive sublimate (1: 3000-8000), phenol (1: 30-60), formalin (1: 1000-6000), permanganate of potash, thymol, hydronaphthol, boric acid, etc.

When, along with the influence of the hot douche, the benefit of an astringent or antiseptic lotion is required, it is best that the patient should first use pure hot water, and immediately afterward the medicated fluid.

Frequency of Employment.—In the ordinary run of cases the patient is ordered to use the douche both in the morning and evening, or only at one of these times. In special cases it may be necessary to order it to be used more frequently.

It is important in inflammatory cases that the douche should not be of too short duration. Where the contraction of blood-vessels, the relief of congestion, or the promotion of absorption is desired, from two quarts to two or three gallons should be used on each occasion. A considerable quantity should be used when an antiseptic is employed. When a cleansing or an astringent action is desired, a quart of fluid usually suffices.

When a patient is to use the douche on account of its thermic effects for some weeks, she should only gradually work up to the larger quantities.

Dangers.—In the great majority the use of the douche is not associated with any unpleasant effects. The danger of fluid being forced into the uterus has already been alluded to. Care must be taken to insure a return outflow from the vagina.

In acute inflammatory affections, especially of ovaries, bladder, or rectum, the douche must be used cautiously. Pelvic pain may be increased or colicky pain started; faintness or marked perspiration is sometimes brought about. When new-growths are present, care must be taken not to damage the tumor wall and cause hemorrhage.

THE VAGINAL TAMPON.

The introduction of a tampon into the vagina may be employed for various reasons.

1. To check hemorrhage, *e. g.*, from the uterine cavity in various conditions. In such a case the most convenient material to employ is sterile gauze, preferably saturated with an antiseptic. The author always uses chinolol (see p. 220). In introducing it the patient should be placed in either the Sims' or lithotomy position, a speculum should be passed, and the gauze firmly packed in the vagina from above downward, the fingers being used for the purpose. If the vagina be long or narrow, dressing forceps may be required.

If an astringent—*e. g.*, a solution of alum or glycerin of tannic acid—be used along with the tampon, the vaginal walls contract more firmly, and the

pressure of the tampon is thereby increased. An antiseptic tampon may be left *in situ* for one, two, or three days.

If there be retention of urine during this time, the urine should be drawn off. If there be much pain, either an anodyne should be given or the lower end of the tampon withdrawn.

If another tampon is to follow, it is well to give the patient a vaginal antiseptic douche before it is introduced.

2. To keep tents in the uterus, gauze or a ball of antiseptic cotton may be used. The tampon need not be large. If wool be used, a piece of string must be tied around it to aid in its extraction.

3. To act as a pessary.

4. To absorb secretions after an operation has been performed, *e. g.*, after an amputation of the cervix. An antiseptic gauze tampon should be placed against the wound, and left there for twelve or eighteen hours; afterward the vaginal douche is used.

5. To introduce certain medicinal agents.

For a considerable period the value of glycerin tampons in the treatment of chronic pelvic inflammation has been recognized. They were introduced by Marion Sims.

To prepare a tampon for use, take a piece of antiseptic absorbent cotton-wool, four or five inches square, and half an inch thick, pour on its center about half an ounce of glycerin; fold in the corners, and compress the mass until it is saturated, and then tie a piece of string around it. If necessary, two or more may be tied in series on one piece of string.

Many are accustomed to prepare the tampon first and then to saturate it thoroughly in the glycerin.

The patient is then placed in the Sims' or lithotomy position, and a speculum passed, and the tampon is pushed well up into the fornix vaginæ.

It may be left in position for twelve to twenty-four hours, perineal pads being worn to prevent the fluid from running down the thighs. It causes a transudation of serum into the vagina from surrounding parts, which is the chief value in the treatment of inflammations. So profuse is the discharge sometimes that the patient may not be able to walk about without discomfort. In the continued use of tampons they may be introduced two or three times a week.

In these inflammatory conditions a solution of ichthyol in glycerin, 1: 10-20, instead of pure glycerin, may be used. Or the following mixture in certain cases: boroglycerin, 1 part; alum, 1 part; pure glycerin, 14 parts.

OTHER METHODS OF MEDICATING THE VAGINA.

1. **Swabbing the Walls.**—Sometimes it is desired to apply some medication to the vaginal walls, without using douche or tampons, *e. g.*, in granular vaginitis.

The patient is placed in the Sims' or lithotomy posture, the cavity exposed with spatular specula, and the walls touched by a swab of wool soaked in the medicament.

A Fergusson speculum may also be used conveniently for this purpose. It is passed up to the fornix, and a medicated swab on the end of a holder

introduced until it touches the cervix. The speculum is withdrawn a little, and then both speculum and swab are slowly withdrawn. The vaginal walls close on the swab as it projects above the end of the speculum, and thus the medicament becomes applied to them.

2. **Powders** may be insufflated into the vagina, when it is opened up by a speculum or by the fingers.

3. **Medicated suppositories** may be introduced, *e. g.*, iodoform suppositories may be used after operations on the vagina or cervix.

Absorption does not take place through the vagina so quickly as through the rectum.

THE UTERINE DOUCHE.

In the treatment of various affections of the uterus it may be necessary to douche the uterine cavity. The stream of fluid is obtained from a reservoir elevated above the patient. The elevation must be slight, because only a stream of small force is wanted. The instrument, which is passed into the uterine cavity, should be of such a nature as to allow of an easy return outflow through the cervix; for this purpose the double catheter of Fritsch or Budin is very suitable.

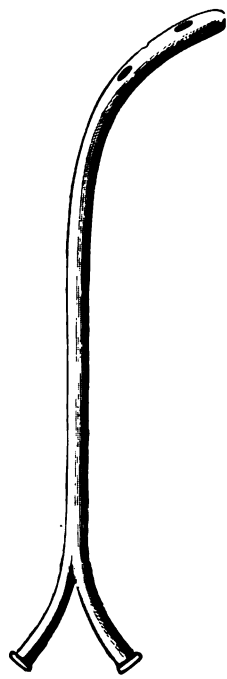


Fig. 109.—Hildebrand's uterine catheter.

Method of Use.—As the uterine douche in gynecology is generally used only with some operative treatment in which the uterine cavity is involved, it is given when the patient is in the lithotomy position. The vulva and vagina should be thoroughly cleansed. The cervix may or may not be steadied with a volsella. A speculum may or may not be introduced into the vagina. The cervix must be large enough to admit the catheter easily without filling it. Artificial dilation must be used if necessary.

The stream should flow through the instrument before it enters the cervix, in order that no air may be introduced. It must be allowed to enter the uterus slowly.

Various forms of lotion are used, *e. g.*, boiled hot water; antiseptic solutions, *e. g.*, formalin, boric acid, corrosive sublimate, phenol, etc.

The great danger in the use of the uterine douche is that the outflow may be stopped, and the fluid forced along the Fallopian tubes.

THE UTERINE TAMPON.

In gynecologic practice the introduction of a tampon for any length of time into the uterine cavity is rarely required. It is used to cause the uterus to contract and to check hemorrhage in certain cases, *e. g.*, after the removal of an intra-uterine polyp, sometimes after the removal of an incomplete abortion where the uterine walls are flabby, in some cases of severe bleeding from

cancer or sarcoma of the uterus. In such cases it is usually combined with the vaginal tampon.

In such cases gauze is the best material to use. It should be carefully introduced by means of a speculum and a long pair of forceps.

In cases in which the cervix is split for stenosis, a small tampon of gauze may be introduced between the raw surfaces for one or more days in order to prevent them from coming together.

In inoperable cases of carcinoma of the cervix, the excavated cavity may sometimes be treated by introducing a tampon soaked in some antiseptic and astringent lotion, *e. g.*, liquor ferri subsulphatis (1 : 2 of water), or phenol lotion (1 : 40) in which is dissolved alum (1 of alum to 12 of lotion). In such cases the vagina is packed as well.

Other Methods of Applying Medicaments to the Uterine Cavity.—

Besides the use of the douche and of the tampon in the special conditions indicated, the following methods may be employed:

1. *The swab* may be used. In order to apply a styptic or an antiseptic to the uterine cavity in diseased conditions or after operations, an ordinary sound or a special vulcanite or metal applicator may be used, its end being covered for an inch or two with a layer of aseptic cotton; or a wooden applicator may be employed and afterward destroyed.

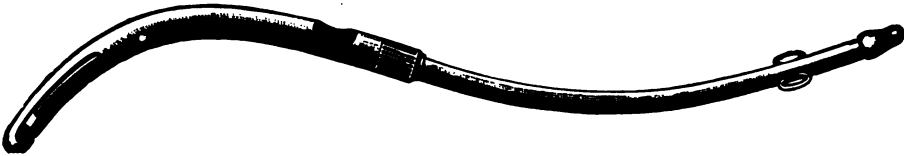


Fig. 110.—Bozeman-Fritsch uterine catheter.

The patient is placed in the Sims' or in the lithotomy position, a speculum passed, and the cervix steadied with a volsella. The cervical canal should be large enough easily to admit the sound. After curetings and other operations there is usually no difficulty in regard to this. First a clean dressed sound should be passed to cleanse the cavity. Then the sound, soaked in the desired medicated fluid, should be introduced. In order to make the application to the whole cavity it may be necessary to pass two or three swabs.

During the application cotton-wool should be held in the vagina, against the cervix, in order to catch any excess of the fluid that may run back from the cervix.

Some of the medicaments employed are the alcoholic solution of iodine (iodine, 70 gr.; iodide of potash, 1½ dr.; alcohol, 1 oz.), iodotannin (a saturated solution of tannin in this iodine mixture), strong phenol, iodized phenol (iodine, 2 parts, with phenol, 8 parts), strong formalin solution.

To remove the dressing from the sound after use it is best to unroll it between the thumb and forefinger under water.

2. *A small syringe* with a narrow nozzle is used by many instead of the swab, especially after cureting, the removal of polyps, etc.

The patient is placed in the lithotomy position, a speculum passed, and the cervix pulled down and steadied with a volsella. The cervical cavity

must be large enough to allow of a *free return outflow* alongside the nozzle. The fluid must be injected very slowly.

The objection to this method is that fluid may be forced along the Fallopian tubes. If, however, the cervical canal be roomy and the injection be made slowly, there is no danger.

3. *Solid medicaments* are seldom introduced into the uterus nowadays. The use of solid caustic is practically given up.

Sometimes, for purposes of antisepsis, iodoform pencils are introduced into the cavity, *e. g.*, after operations on the uterus.

THE USE OF BATHS.

In chronic inflammatory pelvic conditions, the judicious use of baths may lead to great improvement in the patient's health. *Entire baths* may be employed. Such a form of treatment is usually carried out at a watering-place. The benefit derived in such cases is partly due to the improvement in the circulation, skin, bowels, kidneys, and other organs from the action of the baths, but mainly to the changed surroundings of the patient, freedom from care and overwork, regularity and simplicity of life, which are part of the bath-treatment. Various saline waters, *e. g.*, those containing common salt, bromids, and iodids, are mostly employed. In the treatment of uterine fibroids, also, similar means may lead to improved health. Sea-baths are also good in many cases.

Hip- or sitz-baths are also very beneficial. They may be hot or cold, and may be given at special watering-places or at hydropathic establishments, or used by patients at their own homes.

The hot hip-bath should be taken immediately before the patient goes to bed. The temperature should be the highest the patient can bear comfortably (110° to 120° F.). She should sit in the tub so that the water covers the pelvis. Her body should be warmly covered at the time. At first she should remain in the bath only for a couple of minutes. Afterward the length of time should gradually be increased, and she can remain seated till the water gets tepid. After the bath the skin should be thoroughly rubbed, and the patient should go to bed.

Sea-water may be used, or water in which two or three handfuls of common salt are dissolved. Two or three tablespoonfuls of mustard, also, improve the condition of the water. If the patient is using the vaginal douche, it is convenient to take it before she leaves the bath.

This treatment should be discontinued during menstruation. It is continued according to the nature of the case. Thus, in certain cases of dysmenorrhea, where the pain occurs just before or at the beginning of the menstrual period, the hip-baths may be taken only for three or four nights before the flow begins. In old inflammatory conditions they may be used every other night for one or more weeks.

Cold hip-baths are also valuable as a stimulus to the circulation. They should be taken in the morning.

MASSAGE.

The value of massage in the treatment of many bodily ailments has been thoroughly established. In recent years its beneficial influence in many chronic pelvic diseases has been pointed out. Massage may be general or local.

General Massage.—In many cases of neurasthenia in women, from whatsoever cause, the employment of systematic massage combined with seclusion, rest in bed, careful feeding, and, perhaps, electricity, has proved of great value in restoring the patient to health.

In some of these cases the advice of the gynecologist is often sought, because one or more of the most prominent symptoms are referred by the patient to the pelvis. There may or may not be any local trouble of importance. If there be none, no local treatment should be undertaken, even though the patient should locate the cause of her illness in the pelvis. Such a case will be best helped by the treatment above indicated, generally referred to as the Weir-Mitchell method. In this treatment, the skin and muscles of the whole body and the joints of the limbs are carefully massaged once or twice a day for half an hour or more at a time; the course lasts for several weeks. In the majority of instances the patients are restored to health.

Local Massage.—In recent years, owing to the work of Brandt, Hartelius, Nissen, Asp, and others, local massage of the pelvis has been employed by different gynecologists in the treatment of chronic pelvic conditions, *e. g.*, versions and flexions, prolapsus uteri, chronic inflammation, fibroids, etc.

These various forms are used:

External—which consists in the stroking and kneading of the lower abdominal region, the flat hand, the fingers, or the knuckles being employed.

Bimanual.—In this, the fingers of one hand are passed into the vagina, into the rectum, or into both of these passages, the outer hand being on the abdomen. The internal finger should not be moved, but should push up and steady the parts which are massaged by the other hand. These forms of massage should last only ten or fifteen minutes. The periphery of swellings should be first manipulated.

Passive.—This consists merely in exercising steady pressure or traction on adhesions. This method should last only a few minutes. After massage, the patient should lie quiet for a short time.

It is always well that this form of treatment should be combined with the use of vaginal douches and baths. The introduction into the vagina of dilators, *e. g.*, Bozeman's, or vulcanite plugs like those of Prochownik, for a few hours in the day, in cases of pelvic adhesions, may help to soften and stretch the tissues, and so will aid the massage.

Contraindications.—All acute inflammations, menstruation, pregnancy, phthisis, distended tubes.

Expediency of Local Massage.—Though the circulation of blood and lymph is undoubtedly benefited, and though the absorption of exudations may be promoted, I think the dangers to the woman's psychic organization are too great to admit the method of pelvic massage to a place among the therapeutic agencies of the gynecologist. It is stated by those who practise this system that the manipulations require to be carried on for weeks or

months. This is sufficient, in my mind, to condemn the method. Stimulation of the sexual centers cannot fail to be brought about, and, as a result of this, the patient may suffer in various ways. I believe that there is scarcely a case in which massage is at all necessary. Equal or better results can be obtained by other therapeutic means. A striking example of this is seen in the treatment of prolapsus uteri. Brandt's massage method in the treatment of this condition is as follows:

The patient, with loosened clothes, lies on a table or couch, cushions being placed under her chest. An assistant passes his fingers into the vagina, and pushes the uterus upward and to the front. It is then drawn up as far as possible. The woman next supports her body on elbows and feet, while the physician forcibly separates and closes her knees three times. This method is troublesome and unpleasant to the patient, and is of very little value. By pessaries or operation much surer benefit may be derived.

Schultze's Method.—Schultze recommends the breaking-down of adhesions under chloroform. This plan has not been much tried; it is dangerous, and should be condemned. There is considerable risk of setting up hemorrhage or of injuring viscera.

THE THERMOCAUTERY.

The thermocautery is valuable in certain cases. It may be used to remove urethral caruncles, small growths on the vulva, piles; to open abscess cavities and cysts of the vulva, to puncture and destroy Nabothian follicles, etc. It is also used as a hemostatic on wounded surfaces.

Instrument.—Pauclin's cautery is the best form. The cones are kept hot by the burning of benzolin vapor, which is pumped continuously through the hollow handle. Cones of various sizes and shapes may be obtained.

Before pumping the vapor, it is necessary to heat the end of the cone in a flame. Care should be taken not to bring the reservoir of benzolin near the latter. The cautery should be used when the cone is dull red in color. If white-hot the hemostatic action is lost.

A button-cone may be used with this cautery if applications are to be made to the spinal region.

The Electrocautery.—Instead of the thermocautery, a point may be used which is heated by an electric current. Skene advocated the use of forceps, heated by an electric current, for the purpose of closing vessels. The heat is used to desiccate or dry the tissues without charring them. He employs a clamp, in the same way, for the purpose of dividing the pedicle of a tumor, *e. g.*, ovarian cyst, and in dividing the broad ligaments in vaginal extirpation of the uterus. The required temperature varies from 170° to 190° F. Downes has recently advocated this method and has devised an improved form of forceps.

Zestocausis.—Pincus has recommended the use of a metal tube heated by steam, the apparatus employed being similar to that employed in vaporization of the uterus, except that the steam does not escape from the tube. Such a form of cautery cannot be recommended because it is far more convenient to use the thermocautery or electric cautery.

ABDOMINAL BANDAGES.

Abdominal bandages may be of service in various conditions, *e. g.*, pendulous belly, with or without pregnancy, tumors of large size in the abdominal cavity, floating kidney, after operations on the abdominal wall, after abdominal section, after childbirth, in separated recti, and umbilical hernia. Abdominal bandages may also be used to keep dressings over the genitals, to hold certain vaginal pessaries. The most common form used after operations is a wide bandage, made of flannel or of linen, long enough to encircle the abdomen and pelvis with the dressings, and to overlap. It should reach from the level of the great trochanters to near the ensiform. The dressings of cotton should be so distributed as to allow of equable pressure by the bandage. With such a bandage the patient must remain as quiet as possible in bed. It is very apt to slip upward. The Scultetus bandage is also very valuable.

When a patient has to wear a bandage, *e. g.*, in a case of pendulous belly, while she moves about, such a form is not convenient, because it tends to become greatly wrinkled and to slip. It may be much improved by the addition of shoulder and thigh straps. In all such cases special bandages made of elastic material are much more serviceable. Support is needed, particularly for the lower abdominal region.

When the bandage is only partly elastic, the elastic portion may be in front, behind, or at the sides. The lower border should fit rather tightly, in order that it may not easily slip up. To prevent creasing and slipping upward with certainty, it is advisable to attach thigh-bands to the bandage. These may be made of silk, covered cloth, or, better, of rubber. They must not fasten too near the middle line, or the bands will tend to slip into the fold between the nates. The chemise should be worn under the bandage.

For floating kidney a similar bandage may be used, along with a hard cushion of wood, vulcanite, or metal, covered with leather, attached at a point over which special pressure is to be made. Or a mere abdominal belt with the cushions attached may suffice, if, in addition, thigh-bands be used to keep the belt in position. Also, a cushion may be kept in position by a truss-like arrangement.

Abdominal bandages are also used for the purpose of keeping dressings in the vulvar or sacral region in position. The commonest form is the well-known T-bandage. A special bandage may be obtained; it consists of an abdominal girdle with four straps attached, two in front and two behind. These straps support a pad which rests against the perineum. Dressings may be kept in place by straps of adhesive plaster, unless the patient objects strongly to their use.

Abdominal bandages are of service in giving attachment to certain vaginal pessaries or perineal supports, in cases of bad prolapse of the uterus or anus, when the patient will not allow operative measures to be employed.

PESSARIES.

During the last few years the opinions of many of the leading gynecologists have undergone a marked change with regard to the value of pessaries in the practice of gynecology. Many forms of pessary have been devised during

the present century, and their claims have been advocated by various physicians of greater or less renown. To refer to them many pages would be needed, and though such a survey might prove interesting, it would scarcely be suitable for a practical treatise at the present time.

Owing to comparatively recent researches, whereby we have acquired much accurate knowledge regarding the physics of the pelvis, the normal relations and movements of the various parts of the pelvic floor, the real significance of their various displacements, and the correct estimation of the symptoms caused by them, the employment of pessaries has been largely lessened. Of very great importance also in bringing about this change are the advances which have been made in the operative treatment of some of the conditions for which pessaries have long been used.

Forms of Pessaries.—Hodge's pessary is a valuable one. It consists of two parallel side-bars joined at the lower end by a straight cross-bar, and at the upper end by a curved bar, whose concavity looks toward the lower end of the pessary. When viewed from the side, it has a sigmoid curve, in order

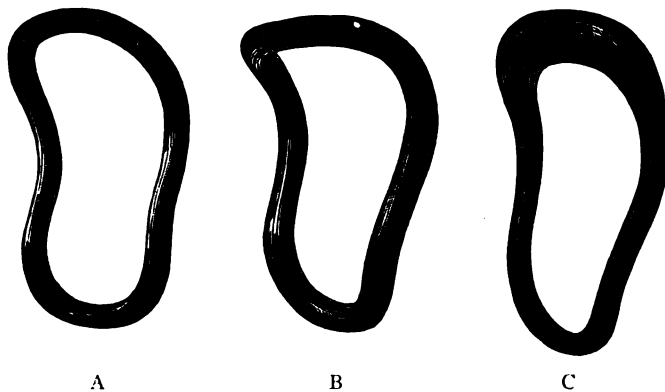


Fig. 111.—Pessaries for retroversion: A, Hodge pessary; B, Smith pessary; C, Thomas pessary.

that it may, when in position, fit the vagina properly. It is best made of vulcanite, because it is pliable if placed in hot water for a little, and so soon can be molded to any desired shape; it gets firm again when cold. Vulcanite does not get soiled as does gutta-percha, and it does not soften in the vagina so easily as celluloid.

The pessary may be obtained in various sizes, and with different degrees of sigmoid curve. Very often the upper end curves too markedly forward.

Albert Smith's pessary consists of two lateral bars joined by rounded ends. The bars are not parallel, but are wider apart at the upper end of the instrument than at the lower. Viewed laterally, it has the sigmoid curve. It is best made of vulcanite. Very often this pessary is too markedly curved forward at the upper end, and the lower end is in many too pointed. It is then apt to slip out of the vagina if the introitus is wide, and is liable to interfere with coitus.

Both of these pessaries may be obtained with transverse bars across their lower part.

Gaillard Thomas' or Mundé's pessary is somewhat similar in shape, but the upper end is thick. It may be made of vulcanite or of guttapercha; when of the latter, this end forms a soft cushion, which fills the posterior fornix when the instrument is in position.

Schultze's figure-of-eight pessary is greatly used in Germany, but it has no advantages over the above-mentioned forms.

The ring pessary is made of various materials, *e. g.*, wood, vulcanite, metal, india-rubber. The most convenient are the india-rubber forms. Some are hollow, containing a spring, others are of solid rubber. The diaphragm-ring is simply the last-mentioned form, with a perforated rubber diaphragm.

Ball or egg pessaries are made of vulcanite or wood.

The Zwanck or Zwanck-Schilling pessary consists of two perforated wings of vulcanite or metal, connected by a hinge-joint. At right angles to them run bars, which are joined to a screw-stem. By means of the screw the wings may be opened out or brought together.

Vagino-abdominal pessaries are those which, though meant for the vagina, are kept in position by means of abdominal support. There are various forms of these. Cutter's may be taken as a type. In it there is a curved stem, which is fastened to an abdominal belt in the middle line of the back, and passes down over the sacral region, anus, and perineum, into the vagina, where it supports a cup on which the uterus rests.

Method of Using Pessaries.—*Preliminaries.*—A careful bimanual examination must be made in order to determine the special requirements of the case, as well as the size of the instrument necessary. If the uterus be retroverted, it must be turned so that the fundus looks toward the front, by means of the sound, or by the fingers, assisted by the genupectoral posture. The patient is then placed on her left side, with the knees drawn up, under cover of a sheet, or she may be left in the lithotomy position.

Introduction of Instrument.—(a) Hodge, Albert Smith, Thomas, or Mundé pessary.

The lower end is grasped between thumb and forefinger of the right hand, the upper end having been greased with vaselin. The labia are separated posteriorly with the fingers of the left hand. When the introitus is narrow, the perineum is pulled back. The instrument is then introduced, with its plane surface, in line with the vulvar slit. It is directed backward toward the sacral hollow, until it is little more than half within the vaginal orifice. The right index-finger is then placed under the pessary against the upper bar, and the instrument is rotated so that its plane surface lies parallel with the vaginal walls. It is then pushed upward until the upper end rests in the posterior fornix.

In pushing it upward the finger must be directed well backward in order to oppose the tendency of the instrument to slip into the anterior fornix. The most difficulty is found where the vagina is narrow and the parts rigid. No pain should be caused by the introduction.

(b) *Ring Pessary.*—This form is introduced in much the same manner

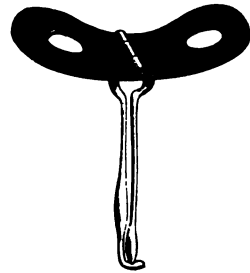


Fig. 112.—Zwanck's pessary for prolapse.

as that just described. When a soft-rubber ring is used, it is compressed by the thumb and forefinger of the right hand while it is being passed through the vulva in order not to stretch the parts and cause pain.

(c) *Zwanck Pessary*.—The wings are brought together, and are then passed into the vagina. The screw of the handle is then turned so as to cause the blades to be separated sufficiently to enable the instrument to remain in position.

After-considerations.—When the pessary has been passed, the patient is asked if she feels any pain or discomfort, and she is made to press down or to cough, in order to determine how the pessary fits. She then rises, and is tested standing erect, with her body bent at right angles to her limbs, in the position of micturition (if necessary), and walking.

The lower end of the instrument must not project beyond the vulva—must not press against the symphysis. It should lie just within the introitus, and should not press hard against the urethra. The upper end should not push up the fornix unduly. The vagina must not be stretched transversely

by the Hodge, Smith, Thomas, and Mundé forms. With the others it must not be too much stretched in this direction. The patient should be instructed to report if she is troubled with discomfort or pain while wearing the instrument.

If the woman douches, the pessary need not be removed and cleansed oftener than once in eight or ten weeks, if it be of vulcanite; sodium bicarbonate in the douche has a cleansing action. Removal should be more frequent in the case of soft rubber, though it is difficult to get patients to bother to return in order to have the instruments changed. The pessary may be worn for months, or for more than a year, according to the necessities of the case.

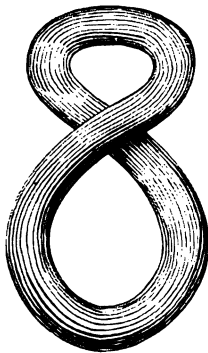


Fig. 113.—Schultze's pessary.

Contraindications to the Use of Pessaries.—

Fixation of the uterus, so that the fundus cannot be turned to the front. Interference with the mobility of the uterus, as a result of some swelling, *e. g.*, tumor of ovary, etc. Recent or, it may be, chronic inflammation in any of the pelvic tissues or viscera. Tenderness of the vagina from vaginitis. Certain tumors of uterus or of vaginal wall.

Some Ill Effects of Pessaries.—Pain may result. The functions of the bladder or of the rectum may be interfered with. Ulceration of the vaginal walls or cervix may occur. Perforation of the rectum, bladder, or of both may take place. Coitus may be made difficult.

These troubles may result from pessaries when they are too large, when misplaced, when not kept clean, when worn too long without change, or when some contraindication has not been regarded.

Mode of Action of Pessaries.—1. Pessaries of the Hodge type. It was formerly taught that when this pessary is in position the intra-abdominal pressure acts chiefly on the lower end of the instrument, thus pushing it downward, and causing the upper end to rise and move somewhat forward in the posterior fornix, thus directing the uterus forward. This is not the explanation. When the pessary is in position it lies in the vaginal slit between the pubic and

sacral segments. Intra-abdominal pressure acts at right angles to every point of the floor, and consequently acts with equal force on all parts of the pessary.

The pessary acts in two ways:

(a) It helps to keep up the uterus as a whole, thus tending toward the relief of the congestion of the organ.

(b) The upper end of the pessary affords a support over which the posterior vaginal wall pulls on the cervix in an upward and backward direction, the body of the uterus consequently tending to be kept forward. In fact, this action makes up for the loss of function in the uterosacral ligaments, which, in the normal state, draw the cervix upward and backward, but which in cases of retroversion of any duration lose this power through the stretching to which they are subjected.

2. Ring pessaries act merely as a general means of support. They lie between the pubic and sacral segments, stretching the vagina more or less. They tend to prevent the vagina or uterus from becoming prolapsed. The ring does not act in the posterior fornix like the Hodge pessary in the majority of cases. Sometimes, it may have this action, and prevent the uterus, which has been replaced, from becoming retroverted again.

3. Zwanck's pessary acts in virtue of the width of its wings. These remain in the vagina, and tend to keep the uterus from descending. Patients sometimes prefer this instrument because they can so easily introduce and remove it.

4. Ball pessaries act merely through occupying a large amount of space in the vagina.

5. Vagino-abdominal pessaries keep up prolapsing parts by means of the suspension from the abdominal band.

THE USE OF ELECTRICITY.

The exact value of galvanic electricity as a therapeutic agent has not yet been definitely established. By some authorities it is employed to an enormous extent in their practice, by others it is not used at all, or only to a very limited extent. A few still hold that in certain cases, *e. g.*, fibroid tumors, its action may lead to the disappearance of abnormal swellings; most, however, believe that it is merely to be ranked among other methods of bringing about improvement in certain symptoms.

One great objection to its use is the time and trouble required.

Apparatus Employed.—The galvanic current is produced by the action of certain solutions on two different metals. In practice, batteries of different sizes are used. It is convenient to employ one in which a considerable strength may be obtained. Stationary or movable batteries may be used. They are usually in the form of a cabinet. Each battery must possess apparatus by which different numbers of cells may be connected with the circuit.

There should be a galvanometer, an indicator of the nature of the two poles, a current interrupter, and a commutator, which enables the current to be quickly altered. With these batteries also the necessary apparatus for producing faradism or electric illumination may be employed.

The rheostat, an instrument which alters the strength of currents by increasing the resistance to their passage may also go along with the battery. It is useful in allowing the current to be gradually increased or diminished without the slightest shock, and thus acts well with nervous patients.

Different forms of terminals or electrodes are employed to bring the current into relationship with the diseased tissues of the pelvis. Electrodes are external and internal. The external electrode is generally applied to the lower part of the abdomen above the pubes, where direct electric action is required; sometimes over the sacrum, where indirect action is wanted. They may be made either of wet potter's clay, half an inch thick, or of block tin or lead, perforated with small holes and lined with a layer of cotton-wool, chamois leather, or rough towel cloth. These electrodes vary from four to ten inches in diameter. The smaller they are, the more the patient is apt to feel pain. Before use they should be moistened in warm water. They should be kept steady while the current is passing by a bandage applied lightly around the abdomen.

Internal electrodes are used in the vagina, in the uterus, in the bladder, in the rectum, or in the substance of masses, *e. g.*, certain fibroids. Most commonly vaginal ones are employed.

Vaginal, rectal, and vesical electrodes are of various shapes and sizes, *e. g.*, round, bulbous, or elongated. The staff on which they are held should be covered with vulcanite or rubber tubing to insulate it.

For the vaginal portion of the cervix a cup-shaped end may be used. For the uterine cavity various forms are used. The most common is that shaped like a uterine sound. Platinum ends should be employed; the positive pole will not corrode this metal. Gold or aluminium is also serviceable. For puncture of tissue a steel needle is used.

Action of Galvanic Current.—It is taught that there is a *polar* action, chemic in nature, that at the positive end differing from that at the negative; and, also, an *interpolar* action as the current flows from one pole to the other. The effects depend upon strength of current and duration.

The effect of the positive pole is described as hardening, coagulating, and hemostatic; it is less painful than the other pole. The effect of the negative pole is said to be to disintegrate tissue, to cause congestion, to favor hemorrhage; it is the caustic, painful pole, being more active chemically than the positive.

Puncture of tissue is carried out chiefly in cases of fibroids where a sound cannot be passed into the uterine cavity; but it may be combined with intra-uterine electrization.

Faradic Electricity.—This may be used externally, internally, or both externally and internally. Where the internal application alone is used, a double electrode, with an insulator between, may be employed.

The chemic action resulting from faradic electricity is very slight. It has mainly a stimulant and contracting effect.

Nature of Applications.—The patient should be douched before and after the application with an antiseptic. She should rest a while afterward. The length of the application is from five to eight minutes in most cases. Where pain is being treated, the duration may be longer. It may be given daily, every other day, or twice a week, according to the conditions

present. Various strengths of currents are used. The highest limit may be considered 300 milliampères. A very common range is from 50 to 150.

CONDITIONS IN WHICH GALVANISM HAS BEEN RECOMMENDED.

Uterine atrophy, superinvolution, infantile uterus, associated with amenorrhea and local loss of tone.

Faradic or galvanic electricity may be tried externally, or best, both externally and internally at the same time. In virgins it may be impossible to carry out the internal application. When the faradic current is used it does not matter which pole is in the uterus or vagina. When the galvanic is used, there is difference of opinion as to which should be introduced; the current should not be strong.

Dysmenorrhea with or without local inflammatory conditions. In these cases the combined external and internal galvanic currents of mild strength are used, the positive pole being internal. In virgins it may be possible to make only external application.

Myoma Uteri.—The galvanic current is used. The internal electrode is placed in the uterine cavity when possible, and is the negative pole unless it is a hemorrhagic case, when the posterior pole is placed there; or the inner electrode may penetrate the tumor for one to two inches. The puncture is made on a part of the fibroid within easy reach. No vessels of any size should be wounded, if possible. The puncture is usually made with the negative pole. The most thorough aseptic precautions must be observed.

Puncture of the tumors through the abdominal wall is to be deprecated.

Metritis and endometritis may be benefited.

Chronic cellulitis, chronic ovaritis, salpingitis, perimetritis, peri-ovaritis, old hematocele, and perisalpingitis are often improved; also pelvic pains in neurotic patients may be helped by applications. The negative pole is usually placed in the vagina.

Affections of the Rectum.—Electricity is used by some in the treatment of hemorrhoids and of prolapse of the bowel. The galvanic current may be passed, one pole being on the abdomen the other in the rectum. Where the piles are large, electropuncture with the positive pole may be used.

Faradism of the bowel is recommended for chronic constipation by some.

Bladder Troubles.—For irritability or incontinence, abdominospinal, abdominovaginal, or abdomino-urethral applications of galvanism may be employed. When there is hypersensitiveness of the neck of the bladder, the positive pole is passed as far as this region.

Ectopic Pregnancy.—The value of electricity in destroying an ectopic pregnancy has not yet been definitely ascertained. Most authorities never employ it, others believe in using it during the first three months of pregnancy. Faradism and galvanism have both been used. The patient should be in bed. One electrode—the negative—is placed in the rectum or vagina, the other on the abdomen over the swelling.

Contraindications and Dangers.—The electric treatment should not be carried out where there is any acute inflammatory condition in the pelvis, nor is it advisable where there is any collection of pus. In some cases it may be advisable not to employ it if the patient is particularly sensitive.

We are not yet sufficiently aware of the dangers that may result from the use of electricity, even in supposed suitable cases. Pelvic inflammation may undoubtedly be set up. Hemorrhage may be started. This may result from the influence of the negative pole, from irritation of the uterine mucosa, or from the perforation of a large vessel when electropuncture has been tried. Septic infection may be caused.

Points to be Attended to During the Application.—The patient must be placed in the dorsal position. It is well to assure her that the application will not be of the nature of a shock. The clothing is loosened and the external electrode is placed on the abdomen and kept steady by the use of a lightly applied bandage. This should be allowed to remain for a little before the current is passed in order that the skin may be well moistened. If there is dryness, more pain will be caused. Any abrasion of the skin should be protected with oiled silk. The electrode should be covered with a dry piece of cloth or of oiled silk to protect the clothes from moisture. The internal electrode is then introduced, the vagina having been thoroughly cleansed. The end of the electrode should be cleansed and dipped in an antiseptic solution. It is introduced as a uterine sound would be, being guided by fingers placed in the vagina. There should be little or no pain in introducing the instrument. If electropuncture is to be made, the uterus must be steadied through the abdominal wall. The wires are now attached to the electrodes, the condition of the apparatus having been tested beforehand. The galvanometer needle is at zero.

The outer electrode may now be lightly pressed against the belly by the patient's or by a nurse's hands. The electrodes must be steady, and the legs should not be allowed to touch them.

It is best not to employ a vaginal speculum. If it must be used, the electrode must not touch it, or a shock will be caused. Neither must the latter be allowed to burn the vaginal wall.

No sudden shock must be allowed, *e. g.*, by the slipping of a wire from a screw. In stopping the application it is best gradually to reduce the strength by turning off the current gradually or by increasing the resistance by the rheostat, until the galvanometer points again to zero. The wires are then removed, next the internal electrode, then the outer. The vagina is then cleansed. After puncture a styptic may be used and an antiseptic vaginal tampon. The patient must rest afterward.

(For full details regarding the use of electricity the works of Apostoli, Engelmann, Cutter, Keith, and others may be referred to.)

CHAPTER VII.

SURGICAL TECHNIC.

ASEPSIS AND ANTISEPSIS.

The field of operation may be infected with micro-organisms in the following ways:

By the hands of the operator, assistants, or nurses. By means of dirty instruments, apparatus, or other paraphernalia used in the operation. By contamination from imperfectly cleansed skin, or from some infected area existing in the patient, *e. g.*, bowel.

By means of the air.

In gynecologic operative work, as in all surgical work, our aim should be to handle the patient so as to keep every wounded surface aseptic from the beginning of the operation until the end of the repair process. In the early period of modern surgery chemic antiseptics were mainly used to obtain this result, but in recent years they have been largely superseded by other agents. Indeed, while the principle of modern surgical technic is very simple, its practical details are elaborate and require keen and constant attention on the part of the operator and his staff.

It is essential that he should have a knowledge of the most important facts in bacteriology, and it is advisable that this information should have been gained by practical work in a bacteriologic laboratory. Training of this kind is best calculated to develop that keen regard for surgical cleanliness which is essential to the acquirement of perfection in technic.

Every operator should supervise the practical work of his assistants not only at the operation, but in the preparation of materials, the details of sterilization, etc. He should also insist upon the methodic training of hands and eyes so that the habit of working with precision may be acquired. Imperfect education may lead to errors as serious as those which proceed from ignorance. Thus, an operator may take a piece of silk from a drawer, soak it for a few minutes in a 1:30 phenol solution or 1:2000 corrosive sublimate, and then use it as a suture, under the belief that he has satisfied all the requirements of modern aseptic technic. Such a proceeding, in the light of present knowledge, is as serious as if he were to pick a suture from the floor and use it, because it has been proved that various dangerous micro-organisms or their spores cannot be destroyed by these solutions unless soaked in them many hours. Then, again, some think that if ligatures or instruments are placed in water raised to the boiling-point a minute or two all germs and spores will be destroyed. This is well known not to be the case. Many also believe that certain dry dressings which are impregnated with antiseptics, now so largely used, are all-powerful destroyers of germs; whereas, in reality, it is only when in contact with liquids that their activity is shown. It is evident, then, that such dry dressings, unless sterilized before they are applied

to wounds, may be carriers of living germs and spores. It is necessary, therefore, to study the best means of carrying out all operative procedures in order that infection of wounds may not occur. In the practice of experts surgical technic is a habit which should be for the most part performed unconsciously. The master-operator acts mostly instinctively, and without effort obeys the rules of cleanliness with exactness. To attain to such perfection it is necessary to undergo a long period of training, the minutest details being practised and often repeated, alertness of mind and intelligence being necessary in order that no error may be committed. Coffey, in a masterly analysis of the psychology of habit in surgical technic,* states that the principal point in arriving at a good surgical technic is education of the muscle sense, and he points out that unless this has been perfected so that a habit is acquired which does not require conscious effort or attention, the operator in crises or emergencies which require his best judgment and reason may easily deviate from the correct line of action and commit more or less serious errors in technic.

In the past the attention of operators has been mainly concentrated on the mechanics of surgery, and it is very common to notice the association of dexterity with habits of uncleanness. In one who has been operating for years it is safe to say that faulty habits cannot be entirely eliminated. They can be abolished only by constant effort in the early years of work. It is, therefore, of great importance that all surgical assistants and nurses should, in the beginning of their career, be carefully instructed and drilled so that the foundations of a strict technic be well established.

It is advisable that an operator should develop one line of technic which may be adapted to varying conditions. Perfection is much more likely to be attained in this way than when a shifting policy is pursued. The best guarantee for the most exact expression of habit is its frequent unvaried repetition.

Preparation of Operator, Assistants, and Nurses.—The operator, assistants, and nurses should not have visited any infectious case immediately previous to the operation, nor should they have touched decaying organic matter. Their arms and hands should be free from any infected lesion, and they should not be suffering from an acute coryza or from catarrhal conditions which cause frequent coughing.

Previous to operation it is advisable that a special clean linen suit should be put on, the arms being bared higher than the elbows. If the clothes are likely to be soiled by discharges or irrigating fluids, a close-fitting clean rubber apron may be worn outside the suit. A clean, close-fitting cotton cap should then be placed on the head to cover the hair. A wide piece of muslin tied around the head serves the same purpose. It is also advisable to tie a piece of folded muslin around the lower part of the face, in order to cover the mouth (and the beard if the operator possesses one). Such a protection prevents the escape of small portions of saliva while the operator talks during his work. If he has a beard, loose hairs and other particles are prevented from falling into the field of operation.

Instead of the above arrangement, the author has adopted a cotton helmet which covers the entire head with the exception of the eyes. The hands should next be sterilized as thoroughly as possible.

*" Jour. Amer. Med. Assoc.," September 6, 1902.

A sterilized gown reaching from the neck to the ankles is then put on. This is tied behind by a nurse. The sleeves should be closely fastened around the wrists by tapes attached to them. Rubber gloves should fit over the lower ends of the sleeves of the gown.

Sterilization of the Hands.—In carrying out hand-sterilization mechanic and chemic methods are employed.

1. *Mechanic.*—The careful use of a stiff nail-brush with soap and hot water results in the removal of microbes lying on the surface, and in the detachment of superficial epidermal cells and grease with contained organisms.

It is held by some that this method suffices to produce practical sterilization. Such a view is, however, erroneous. While it is certain that prolonged



Fig. 114.—Head of operator or assistant covered previous to operation

washing of the hands in hot soapsuds reduces the number of microbes in the skin, the time required to establish sterilization is far beyond the limit of practicability. A laundry-woman's hands at the end of a day's washing have probably fewer germs between the cells of the epidermis, in the sweat-ducts, and sebaceous follicles than may be found in those of a surgeon after he has prepared himself for an operation by any of the present methods of sterilization.

It is, however, impossible to produce such a state of skin by scrubbing for five, ten, or fifteen minutes or any period of reasonable length. Moreover, this rapid method is very apt to irritate the hands, both by the friction of the brush and by the action of strong alkali in the soap. Apart from the personal

discomfort thus produced, the skin is roughened and covered with partly detached epidermis containing microbes, and may thus be a source of danger if the naked hands be used in operating. When the skin tends to become thus affected, it is advisable, as suggested by Haegler, to rub the surface with a dry rough cloth in order to remove the shreds of epidermis and render it more smooth. Various operators have advised the use of sand, marble-dust, fine wood-shavings, etc., instead of the nail-brush, and have stated that better results may be obtained. Careful bacteriologic experiments

show that this is not the case. Cultures may be obtained from the skin as readily after the use of these substances as after scrubbing with the nail-brush. Their one advantage is that the skin is usually left smooth after they are employed.

Special soaps have also been introduced, *e. g.*, soft, green, or strongly alkaline soap, Schleich's marble-dust or antiseptic soaps. These are unnecessary. Any ordinary soap which forms a good lather and contains sufficient free alkali to emulsify the fat in the skin is satisfactory. Any variety which is an irritant should be discarded. The uselessness of all soaps containing antiseptics may be demonstrated by careful bacteriologic tests.

Many of the variations in the opinions given regarding the sterilization of the hands are due to faulty test-methods. Thus statements based on the study of the dry skin are certain to be fallacious. When a bacteriologic test is to be made, the surface should be well moistened with sterile water. The method of stroking the surface with a platinum loop, a narrow dull-edged spatula, or a piece of cotton wrapped around a rod is entirely insufficient. A sharp-edged instrument capable of loosening the epidermal cells should be used, *e. g.*, Fürbringer's small pieces of hard wood or Leedham-Green's rough ivory ends, which, after application, are dropped into the culture-



Fig. 115. -Operator or assistant ready for operation.

medium. A long stiff metal rod whose end is flattened like an arrow-head and having sharp edges is also very suitable. Haegler has used short pieces of sterile silk ligature; these are well rubbed against the skin and under the nails. As to a culture-medium, that one should be employed which enables the observer to count colonies and so to establish some degree of comparative study.

Leedham-Green, in his monograph, strongly recommends tubes of agar. Previous to their inoculation they are heated in order to liquefy the agar, and then cooled nearly to the point at which solidification occurs. Inoculation is then carried out, the scrapings being distributed through the medium,

and the tubes slanted until the latter is solid. They are then incubated at body-temperature for six days, after which germ colonies may be counted with a low magnifying-glass. A fluid medium, like broth, is not advisable, nor is gelatin suitable, as it does not permit of incubation at body-temperature.

2. *Chemic.*—A recapitulation and analysis of the various chemic methods used in hand-sterilization are beyond the limits of this work. A few general statements will suffice. Many erroneous views have been advanced, largely due to faulty laboratory methods. Tests of the skin made after the employment of antiseptics may be fallacious if sufficient care be not taken to eliminate entirely the influence of the antiseptic. An infinitesimal quantity of the latter, while having no germicidal influence, may prove inhibitory to organismal growth for several weeks in a culture-medium. Thus Haegler has found that one part of corrosive sublimate in 200,000 of bouillon suffices to prevent the growth of staphylococci. A culture-medium may, therefore, contain living organisms even when it appears to be sterile. In making tests it is



Fig. 116.—Arm of operator or assistant ready for operation. The glove is drawn over the wrist of the sterile gown.

consequently necessary to remove the antiseptic from the test-object or neutralize its action. That it is not very easy to accomplish this is proved by recent experiments. Indeed, Leedham-Green states that the examination of the culture-tubes after six days is not sufficient in cases in which antiseptics have been used. Frequently, after several weeks, evidence of germ growth may be obtained, owing to the gradual lessening of the inhibitory influence of the contained antiseptic.

The work of Paul and Sarwey, Haegler, Schaeffer, Leedham-Green, and others has demonstrated that the ordinary operating-room methods are to a considerable extent inefficacious in rendering the hands sterile, either by removing germs from the skin or by destroying those still present after scrubbing. It seems absurd that so many operators are satisfied with immersion of the hands for a few minutes in chemic solutions in which many germs and spores may live for hours or days. Above all does it appear illogical to use aqueous preparations which cannot penetrate the epidermis because of the compact arrangement of the cells and the presence of fatty matter. A much employed lotion is a watery solution of corrosive sublimate

(1:1000), but its weakness has been so often demonstrated that it is a wonder that any operator ever uses it. Leedham-Green inoculated silk thread with cultures of *Staphylococcus aureus*, and found that the organism developed in broth after five, ten, and fifteen minutes' immersion in the sublimate. Opitz also found that staphylococcus could be made to develop even after thirty minutes' immersion in the same solution.

Some variations in the results obtained by experiments may be expected, because of the difficulty of establishing uniformity in conditions. Different cultures of an organism vary in their susceptibility to the antiseptic. The age of the growth, the temperature at which it had been kept, the nature of the culture-medium, the number of organisms on the test-objects, and the temperature at which the latter are dried, are the factors which determine the variations.

Thread-tests, such as those described, are not comparable to the conditions present in the hand-sterilization methods of the operating-room. In the former the antiseptic has free access to the organisms; in the latter it cannot even reach the microbes, protected, as they are, by the fatty and albuminoid epidermis. If the test-objects after being soaked in the germ cultures are coated with oil and afterward placed in the watery antiseptic solution, the latter may exert no influence until hours or days have passed, as Haegler and others have found.

It is, indeed, quite evident that an antiseptic, to be capable of sterilizing the skin, must be one which can penetrate the epidermis.

Fürbringer first pointed out the necessity of dissolving the fatty material in order to allow the antiseptic solution to act, and he introduced alcohol for this purpose. In recent years alcohol has been widely employed alone or in conjunction with other solutions. Reinicke and Ahlfeld have been enthusiastic advocates of the value of alcohol in sterilizing the skin, but a large number of authorities have raised many doubts as to its efficacy. Leedham-Green's extended experiments have clearly proved that the skin may be well cleansed by scrubbing it with alcohol, the number of organisms being reduced; the longer the application, the better the results. In a very considerable percentage of his cases, however, the skin was not rendered sterile, and it was found that the prolonged use of the alcohol, *i. e.*, more than five minutes, caused considerable pain, roughened the skin, and even produced eczema.

Regarding the germicidal power of alcohol, it seems clearly established that absolute alcohol is very weak, but that the diluted fluid has some action (Epstein, Haegler, Minervini, Leedham-Green). The latter states that the 70 per cent. solution has a greater germicidal power than a watery solution of bichlorid or biniodid of mercury (1:1000) or of permanganate of potash (saturated). It may destroy staphylococci and other nonspore-bearing organisms in two to five minutes if the latter are not abundant and are easily accessible; under other circumstances a much longer period is required.

The chief value of alcohol in hand-cleansing, according to Schaeffer, is its power of detaching the flakes of epidermis which have been loosened by previous scrubbing in soap and water, and not its influence as a germicide. Leedham-Green points out that often if the spirit in which the hands have been cleansed be filtered, living organisms may be obtained from the sediment, even though the tested hands have proved sterile.

The astringent hardening influence of the alcohol must also be considered. Immediately after its use the skin may be apparently sterile, whereas after macerating the latter in albuminous fluid or normal saline solutions cultures may be obtained in a considerable percentage of cases.

Fürbringer's method of washing the hands in corrosive sublimate solution after the preliminary use of alcohol is undoubtedly the one most widely employed at the present day. While it is more efficacious than alcohol alone, or than potassium permanganate and oxalic acid, it fails in effecting perfect sterilization of the skin in a considerable percentage of cases. The best results are obtained when the period of application is lengthened, but undue prolongation is apt to injure the hands.

For several years the author has been experimenting for the purpose of attaining to greater perfection in the sterilization of the hands. He has held that the ideal cleansing agent must be a solution capable of dissolving fatty matter and of penetrating the epidermis, strongly germicidal when applied for a few minutes, and noninjurious to the skin.

In 1897 he obtained a preparation from England named crenasol, which acted very satisfactorily. Its composition was practically the same as pure creolin, but with less soda. Two years ago, however, the export of the fluid to this country ceased, and a mixture of creolin (eight parts) and glycerin (two parts) was substituted. This is the strongest solution of creolin which can be rubbed into the skin for three or four minutes without causing considerable pain and irritation. Some people cannot even endure this strength.

In 1904 the author began to use ordinary unpurified clove oil, and he has obtained with it better results than any other method has given. It is recommended in preference to purified clove oil, because it is less expensive and probably a better germicide, its impurities being acid in nature. It is a powerful solvent of fats and penetrates deeply into the skin. It is used as follows:

The hands are scrubbed for five minutes with any good soap and hot water, the latter being frequently changed. A boiled stiff nail-brush is used. The skin is then dried with a sterile towel, and rubbed for one minute with alcohol in order to remove any remaining moisture. When it is dry, the clove oil is rubbed into the skin for four or five minutes and afterward washed off with alcohol.

Occasionally there is a disagreeable burning sensation, but no injury results. This unpleasantness is usually more marked when the alcohol used is considerably below the absolute strength. The hands thus cleansed are thoroughly rubbed with sterilized talc powder and covered with smooth dry rubber gloves which have been boiled for fifteen minutes. This method certainly reduces to a minimum the risk of infection from hands. It must be adopted by the operator, his assistants, and nurses.

The author objects strongly to the use of wet gloves, because the hands become macerated, and if an injury to the glove is undetected during the operation, the softened skin may more readily yield organisms which have not been destroyed, and these may contaminate the patient.

When the dry method is adopted, the skin of the hand is the same at the end of the operation as at the beginning. It is very smooth, the sterile talc having been rubbed into all the irregularities. An operator should wear gloves

of medium thickness, which are made from a model of his hands. In this way a perfect fit is obtained. If the material be too thin, it is easily ruptured. A quality should be used which affords sufficient strength and does not interfere with the sense of touch. If critics who oppose the use of gloves on the ground of interference with tactile sensibility would exercise care in the selection of the proper grade of rubber, they would do the cause of aseptic surgery a good service. The author has used gloves for eight years, with the most satisfactory results. He desires to protest strongly against the practice of those who use them without preliminary efforts to sterilize the hands as carefully as possible. This extra precaution takes time and trouble, of course, but it is a safer procedure than the other. It is difficult to keep gloves in perfect order, and small holes are often not discovered during operations. If the skin be merely washed in soap and water, it is dirty and dangerous, even though the opening in the glove be in one finger only. In an operation lasting one or two hours it is conceivable that a considerable number of organisms might be washed through the hole into the patient's tissues.

Various surgeons have suggested the use of "hand-coatings" instead of gloves, *e. g.*, wax, varnish, paraffin, guttapercha solution. These are apt to crack and peel off in long operations, and are not so practicable as suitable rubber gloves. The great advantage of gloves over naked hands is that the surgeon may handle all classes of cases with impunity. It has been clearly demonstrated that the difficulty of cleansing the hands is greatly increased when the latter have been in contact with actively infective fluid or tissues. If, for example, an abdominal operation be performed in a case of septic peritonitis, the operator using his naked hands, it is certain that he should not operate again until several days have elapsed and frequent hand-cleansings have been carried out. If gloves are used, no such delays are necessary. The hands are kept free from contamination.

Each assistant and nurse who may touch the wound or handle anything which comes into contact with the operator's hands or the field of operation should make the same preparations as the operator.

During the operation the gloved hands may be rinsed from time to time in hot sterile normal saline solution. If a glove should be pricked or torn, it should be removed and another substituted for it.

Preparation of Instruments.—Instruments should be made as simple as possible, so that they may easily be cleaned. They should be made entirely of metal, and all locks should be separable. Hemostatic forceps with finely grooved blades should be avoided. Instruments in constant use need not be nickel-plated. Those used only occasionally should be plated to prevent them from rusting.

Various methods have been employed for sterilizing instruments, *e. g.*, hot air, steam, antiseptic solutions, etc. The most convenient method is boiling, after the instruments have been thoroughly scrubbed in soap and water with a brush.

If pure water be used, the instruments are apt to become rusted. This may be avoided if sodium carbonate (washing-soda) be added, in the proportion of one teaspoonful to a pint. This solution also allows of more rapid sterilization, its boiling-point being higher than that of pure water; it also dissolves grease. Tavel states that a 0.75 per cent. solution of common salt

is also more efficacious than pure water. Previous to the operation the instruments are placed in a tray, which is lowered into the boiling solution of sodium carbonate and covered by it. They are removed in eight minutes, a period sufficient to destroy all bacteria and all spores which belong to organisms capable of being pathogenic to human beings. The instruments are then placed in sterilized flat glass or enameled metal trays, and they are covered with sterilized towels until the operator needs them. During the operation, as the instruments become soiled with blood, they are washed in normal salt solution. Those which touch an infected area are removed and resterilized. After the operation all those which have been used are scrubbed, boiled, dried, and placed on glass shelves in a closed cabinet.

Special attention must be given to the knives. If they are boiled, the blades should be well covered with cotton. Many operators think that boiling interferes with their edges, and prefer to sterilize them by means of strong antiseptics. For this purpose pure creolin, lysol, or phenol may be used, an application of two minutes being necessary; they are washed in sterilized water before being given to the operator.

Basins, trays, and pitchers may be sterilized by steam under pressure, each article being enveloped in a cloth cover. In the absence of the steam sterilizer they may be prepared as follows. Each should be scrubbed in soap and water, dried, and then washed with alcohol. Then they should be immersed for an hour or more in a tank containing formalin solution (1 dr. to 1 pint) or periodid of mercury (1:500). If no tank is available, each vessel should be scrubbed with pure formalin or phenol solution before use.

Small glass articles, *e. g.*, irrigating nozzles, graduated measures, etc., are best sterilized by boiling for eight minutes in the soda solution.

Rubber tubing should also be boiled in the soda solution, being covered in a cloth wrapping to protect the rubber from contact with the metal vessel. Afterward it should be kept ready for use in a glass jar, containing a solution of phenol (1:15) or chinosol (1:1000). Vulcanite should not be boiled, but should be sterilized by continued immersion in a solution of periodid of mercury (1:500).

Gauze, Cotton-wool Swabs, Towels, etc.—All cloth articles are best sterilized in a chamber in which steam circulates under pressure. Various forms of apparatus are used. In hospitals it is advantageous to employ large machines in which many articles may be sterilized at one time.

The sheets, towels, swabs, etc., should be prepared in small thin packages, each inclosed in a cloth cover, on the outside of which the name of the inclosed article is written.

For operations in which the abdominal cavity is opened it is necessary to use a definite number of gauze sponges. These should be made in three sizes—large, medium, small. Each sponge consists of several thicknesses of gauze hemmed at the edges, a piece of tape six inches in length being stitched to one corner. These sponges should be sterilized in gauze-covered packages, each containing six; they should be opened and counted just before the operation.

Before the steam sterilizer is used, all cold air should be expelled from the chamber. If the steam circulates under a pressure of forty to fifty pounds

per square inch at a temperature of 100° to 130° C., the articles may be removed in an hour, a time more than sufficient for satisfactory sterilization. Sterilization by dry heat in a hot-air chamber may also be employed, but it is not so satisfactory as the steam method, as a longer period is necessary. It requires an exposure of an hour and a half at a temperature of 100° C. to destroy the ordinary nonspore-forming bacteria, and a three-hour exposure at 140° C. to destroy spores. Moreover, dry heat is more destructive to the materials and does not penetrate them so well as steam.

Preparation of Sutures and Ligatures.—*Silver wire* has been used considerably in gynecologic surgery, but it has been to a great extent discarded in recent years. It may be sterilized by boiling in soda solution.

Silk, twisted or plaited, is used in various sizes, being strong and durable. Many object to it because it is not solid, but allows a capillary flow to take place along it. The latter objection may be overcome by filling the interstices of the silk with guttapercha in the following manner:

The silk is wound on glass slides and boiled for thirty minutes in 1 per cent. soda solution. It is then soaked in sterile water for six hours, and again boiled in water for thirty minutes. After being washed in alcohol and dried it is placed for forty-eight hours in a solution of guttapercha (1 part) in turpentine (10 parts). It is then boiled one hour in normal saline solution, and afterward stored in a solution of chinosol (1:500) or an alcoholic solution of periodid of mercury 1:800.

Silkworm-gut is impermeable and nonabsorbent, but is not very flexible. It may be sterilized by half an hour's boiling. To render the strands pliable they should be placed in sterile water or normal saline solution for half an hour before operation.

Linen thread impregnated with celloidin has been recommended by Gubaroff, whose method of preparation is as follows:

The threads are boiled in a soda solution to remove grease, and afterward are washed in cold water. They are then boiled for six minutes, and next placed in absolute alcohol for six hours, when this process is again repeated. From the alcohol they are placed in a warm chamber to dry, and are then rolled on glass spools. These are placed for twenty-four hours in a 30 per cent. solution of celloidin in equal parts of alcohol and ether, to which is added 1 per cent. of sterilized castor-oil. The sutures are then rolled on a wooden frame to dry, and the excess of celloidin is removed by the fingers or with clean paper. They are kept in a closed glass vessel, and before use are twice boiled in a 1:1000 solution of corrosive sublimate.

Catgut.—There is no doubt that this is by far the most widely employed and serviceable material for ligatures and sutures. It may be obtained in various sizes (Nos. 0 to 4). The great advantage of catgut is that it lasts long enough for purposes of healing, and that it is then absorbed by the tissues when in position. Its durability depends upon its size and nature. The range of formalin gut is from one to three weeks. Chromicized gut is more durable.

It must be noted that catgut may easily rot if kept too long, or if not carefully prepared or preserved. It tends to fray out if at all injured, and the knot may slip if not carefully tied. The latter should be triple and not double.

Different preparations of catgut are employed. The author uses with the greatest satisfaction formalin catgut, prepared as follows: The gut is soaked in ether, six to twenty-four hours, according to the size, to dissolve out the fat. It is then rolled evenly and taut on glass rods, the ends being securely tied. The rods are then immersed in a 5 per cent. solution of formalin for twenty-four hours. They are then washed in sterile water, and boiled in water ten to eighteen minutes, according to the size, being covered with cotton so that the catgut shall not touch the vessel. They are stored in sterilized air-tight jars containing the following solution:

Binioid of mercury,.....	1 part
Sterile glycerin,	200 parts
Alcohol (70 per cent.),.....	600 parts.

Claudius' method of preparing catgut has been very highly praised by various operators. The stretched gut wound on reels is soaked for eight days in the following solution: iodine, 1 part; iodide of potassium, sufficient quantity to saturate; distilled water, sufficient to make 100 parts. Before it is used the gut should be washed in sterile water. Mann uses a 10 per cent. solution of iodine scales in ether. After soaking in this for a week the gut may be kept in absolute alcohol.

Chromicized gut is prepared as follows: The gut is soaked in ether six to twenty-four hours, according to the size. It is then immersed for two to seven days, according to the size, in the following solution:

Chromium trioxid,.....	gr. iv
Phenol (95 per cent.),.....	3j
Alcohol (95 per cent.),.....	3xx.

Afterward the gut is wound on glass rods, the ends being securely tied. It is then placed in a brass vessel full of alcohol, the tops being tightly screwed down so as to be impervious to air or water. The vessel is then immersed in boiling water for three-quarters of an hour.

Horse-hair is used chiefly for the purpose of approximating the skin edges of an abdominal incision between the main supporting sutures. Catgut, fine silkworm-gut, or fine gutta serena silk serves the same purpose.

Cleansing of the Patient.—(a) *In Operations on the Genital Tract Performed in the Lithotomy Position.*—The patient should take a bath the night before operation, if she is able. If she is confined to her bed, the nurse should wash her thoroughly. The vulvar region should then be completely shaved and cleansed. (It is advisable that the head should have been well washed within a few days previous to operation.)

If any septic condition exists in the genital tract, the vagina should be douched twice daily with formalin solution (25 drops to a pint), and the evening before operation a vaginal tampon soaked in this solution should be inserted. If no septic condition exists, it is sufficient to douche the vagina. When the patient is a virgin with undilated hymen, there need be no interference with the vagina. The vulva should be covered with gauze saturated in the formalin solution, over which oiled paper or protective is applied and held in position by a T-bandage.

The digestive tract should have been regulated for some days previously. The evening before operation an aperient dose should be given, and in the morning a soap-suds enema should be administered. After the bowels have moved, the rectum should be washed out with warm normal saline solution.

In the past operators have practised excessive zeal in the use of purgatives prior to operation. While it is important that the alimentary tract should be in a good condition, this end should be attained rather by careful dieting. Free purgation may weaken the patient and lessen her resisting power. Castor-oil, licorice powder, or any ordinary laxative pill usually suffices. Colonic flushing is of the greatest value as a preparatory measure.

A pair of ordinary clean stockings should then be placed on the limbs, and over these long cotton covers, which reach well up the thighs. In moving the patient to the operating-room she should be kept warm.

When she is placed in the lithotomy position, the external genitals, vagina, and buttocks should be well washed in soap and sterile water. The vagina should be washed with lysol (1:100), creolin (1:100), or formalin solution (25 drops to a pint).

The external parts should be dried, and a solution of creolin (8 parts) in glycerin (2 parts) applied for two minutes. This should then be removed with gauze soaked in alcohol. The vagina is then washed out with alcohol. The urine should be carefully removed from the bladder, a sterile glass catheter being used.

(b) *In Cases of Abdominal Section.*—The preparatory measures described above are advisable in cases in which abdominal section is to be performed, for very often the procedure is accompanied by preliminary operative work in the lithotomy position. Even though the latter may not be carried out, it is sometimes necessary in an abdominal section to open into the vagina.

The lower abdominal region, as well as the vulva, should be shaved. The whole abdomen is scrubbed with soap and warm water, special care being given to cleansing the navel. The skin is then thoroughly washed with alcohol. A pad of gauze soaked in a solution of formalin (40 min.), glycerin (4 oz.), water (16 oz.) is then applied to the anterior abdominal surface. Over it is placed a large piece of protective or oiled paper, and the whole dressing is held in position by means of an abdominal binder. This is not removed until the patient is in the dorsal position on the operation-table. The anterior abdominal wall is then thoroughly washed with alcohol, and afterward a mixture of creolin (8 parts) and glycerin (2 parts) or crude clove oil is rubbed into the skin; this is washed off with alcohol. The sterile covers may then be applied.

Cleansing the Air and Contents of the Room.—In the early days of antiseptic surgery great attention was directed to the air infection of wounds. At the present time it is recognized that it is very much less to be feared as a source of danger than infection by contact or by implantation.

Rosenow has recently made a careful bacteriologic investigation of the air of dwelling-, sleeping-, operating-, and dressing-rooms, exposing the moist surface of freshly prepared nutrient plates for definite periods, and he has found that under ideal conditions the air of a quiet, unoccupied room in a city dwelling contains a considerable number of bacteria. These are greatly increased by poor ventilating arrangements, by drafts, or when there is dust. It is quite evident that in a prolonged operation a large number of organisms are accumulated on the operation-field, as well as on the sterile dressings, instruments, etc. While most of these bacteria are harmless molds, saprophytes, etc., pathogenic organisms are almost invariably present. These

are most abundant in the air of surgical dressing-rooms, and are increased by epidemics of tonsillitis, pharyngitis, and influenza. The greatest care should consequently be taken to keep the air of an operating-room as pure as possible. In a hospital it should be so situated and constructed that outside dust may not enter through doors and cracks nor accumulate in inaccessible recesses. It should be capable of easy cleansing, and this should be frequently carried out. The contents of the room should be limited to bare necessities, and as many articles as possible should be made of enameled metal and glass, so that they may be easily cleaned. The room must be connected with a heating system, so that in cold weather the temperature may be raised to 80° or 85° F. It goes without saying that no source of decaying organic material should be near the room.

No one suffering from acute influenza, tonsillitis, or pharyngitis should be allowed to enter the operating-room before or during an operation. The operator, assistants, and nurses should wear gauze pads over mouth and nose, in order that particles contained in the expired air may not contaminate the sterilized field of operation. Many operators neglect this precaution, believing it to be unimportant. It has, however, been amply demonstrated that small particles of mucus-containing bacteria are very frequently exhaled in ordinary respiration, and to a much greater extent if talking is carried on.

When an operation which is not an emergency procedure is to be performed in a private house, a well-lighted room should be selected. Hangings, pictures, rugs, and all unnecessary articles should be taken out; dust should be removed and the floor scrubbed. Many operators advise that two days previous to operation the room should be tightly closed and fumigated with formalin vapor. This procedure is not a necessity unless the house has recently contained a case of infectious or septic disease.

Chemic Disinfection.—Chemic antiseptics are much less frequently employed in surgery than they were formerly. During operations they are rarely necessary. Beforehand they are widely employed in cleansing the skin of the operator and assistants, and afterward they may be necessary in counteracting infection. Many antiseptics have been employed, and different opinions exist as to their relative merits.

Doubtless the ideal substance remains yet to be found. Something is needed which is capable of varied uses, which is fairly staple, cheap, quick-acting, powerful, soluble in water, not toxic to the patient, nor easily decomposed or rendered inert during disinfection. It should not have a bad odor.

Chinosol.—This substance, obtained by the action of potassium pyrosulphite on oxyquinolin in alcohol solution, is a yellow powder with a faint aromatic odor and a somewhat astringent taste. It is soluble in any proportion in water. It is practically nonpoisonous and nonirritant, even when used in the strongest proportions required. It does not coagulate albumin, nor does it appear to be impaired by contact with fluids and tissues of the body. It is germicidal only in strong solutions (1:100), but even in very weak solutions, *e. g.*, 1:10,000 to 1:20,000, it has a marked influence in inhibiting the growth of bacteria. It may be used as a dusting-powder alone or mixed with boric acid, and is better than iodoform. It is also put in soap and ointments. It is of great value in preparing antiseptic gauze,

being more powerful than iodoform, and without its unpleasant odor or toxic effects.

Chinosol gauze may be prepared as follows: The prepared strips of gauze are dipped in the following solution:

Chinosol powder,.....	1 part
Glycerin,	2 parts
Sterile water,.....	20 "

They are then hung up to dry, and are afterward arranged in rolls, covered with cotton. These are sterilized in the steam chamber.

The chief objections to chinosol are its relatively high cost and the yellow stain which it makes on clothing.

Formalin.—This is a trade name given to an aqueous solution of formaldehyd gas. It is prepared by the oxidation of methyl-alcohol as the latter is passed over incandescent platinum. The commercial solution of formalin is usually advertised as containing 40 per cent. of formaldehyd, but most preparations are weaker than this. It is rare to obtain a specimen as strong as 38 per cent. The gas evaporates easily, and at a temperature of 20° C. is changed to a polymeric form known as paraformaldehyd, a white substance, almost insoluble in water. Great care should, therefore, be exercised by those who use formalin in testing the quality of the samples obtained. The power of the gas as a disinfectant of rooms, furniture, etc., is now well established, but it is also of great value in surgical work. It is very penetrating, especially in glycerinated solution. It is not rendered inert by contact with the fluids or tissues of the body, nor does it injure them in the strengths ordinarily employed. It is not toxic to the system except when large quantities of strong solutions are absorbed, and these are outside the limits of its practical application. The action of formalin can be stopped with ammonia, which forms with it a harmless compound.

Creolin.—In its pure form creolin is germicidal. Diluted with two parts of glycerin to eight of creolin it may be rubbed into the skin for two or three minutes, and is much more penetrating than watery solutions. It is often used in a strength of 1:100, but such a solution has little germicidal power.

Corrosive Sublimate.—This substance, so much used in the past, has passed largely out of favor. The author has entirely abandoned it in surgical work. While it has undoubtedly a powerful germicidal action, the claims originally made by Koch have not been sustained, and there are serious objections to its use.

Geppert's experiments have shown that its strength is not so great as was first claimed. Abbott has also shown that a given amount of sublimate can render inert only a given number of bacteria, the process being a chemic one, a combination of the salt taking place with the cell-protoplasm. The disinfecting power is greatly influenced by the albuminous material present in the medium containing the bacteria. A pure corrosive solution forms insoluble and inactive albuminate of mercury, its power being, therefore, weakened. To prevent this, common salt or tartaric acid should be added. Thus a 1 per cent. solution of either of these should be used in making a 1:1000 corrosive solution. The tartaric acid should first be added; if the acid be placed in a strong solution of sublimate, the latter is changed to calomel in two or three weeks. Recently, ammonio-

mercuric chlorid, sal alembroth, has been introduced in place of sublimate, as it does not unite with albumin so quickly as the latter. A great objection to the use of sublimate solution is the risk of a general toxic action from absorption. On freshly denuded surfaces it has a destructive action even in weak solution, as Halsted has shown. It corrodes metal instruments.

Binioid of Mercury (Mercuric Iodid).—This salt is more valuable than the sublimate. It is not so toxic to the system. It does not form insoluble compounds with albumin, and it does not corrode metals to a great extent. The red crystalline salt is almost insoluble in water, but is soluble with an equal weight of iodid of potassium or sodium; the latter should be first dissolved in the water. Sometimes the mercuric iodid contains traces of mercurous iodid; this produces a green precipitate and interferes with the strength of the solution. When hard water is used, an extra amount of potassium iodid should be added.

Phenol.—This substance was formerly greatly employed in surgical work, but it is much less used now than it was formerly. Its germicidal power, so far as its solutions are concerned, is not so great as has always been believed. Phenyllic oils are of little value. Mixtures of phenol and glycerin are inert until water is added. One great objection to its use is its easy absorption into the system, causing toxic symptoms. It frequently acts unpleasantly on the hands of the operator.

Lysol.—This is an alkaline fluid, derived from the saponification of creols. It is incompatible with acids. It is said to be a stronger germicide than phenol, and less poisonous. It is used in a strength of 1:100 as a douche, for washing the hands, and for instruments.

Thymol.—This substance is a good antiseptic. As one part is soluble only in 1500 of water, glycerin should be added if stronger solutions are desired. Ordinary strengths employed are 1:1000 to 1:2000.

Ferripyrin.—This substance is highly recommended by Witkowski as an astringent, anesthetic antiseptic, without irritant action. A 16 per cent. watery solution may be applied to a bleeding or diseased surface with a swab or dressed sound. A 1.5 per cent. solution may be used for irrigation of wounds or on plugs. Solutions varying in strength from 1 to 16 per cent. can be used for vesical hemorrhage. In stomach or bowel hemorrhage it may be administered by the mouth.

Iodoform.—Many varying opinions are held as to the value of iodoform. Its importance has undoubtedly been overestimated. It has a feeble action on bacteria and spores, but it can neutralize their toxins or ptomains. Its value is chiefly exhibited when a putrefactive or septic process begins. It is used as a powder, in emulsion, in solutions of alcohol and ether, and in suppositories. Iodoform gauze may be made as follows: pure gauze is sterilized by boiling, and then soaked in the following solution:

Iodoform,.....	50 gm.
Glycerin,	100 "
Ether,.....	700 "

The gauze is then passed through a drying roller-machine, and dried at a temperature of 30° C. It can then be preserved in air-tight cases. Tannin may also be added to give the gauze an astringent hemostatic action. Sterilization of iodoform gauze may be carried out by boiling, by hot air, or steam.

A dusting-powder may be made by mixing iodoform (1 part) and boric acid (7 parts). This should be placed in ignition tubes and sterilized. The odor of iodoform is a great objection to its use. Toxic effects are produced by its absorption, *e. g.*, rise of temperature, rapid pulse, mental dulness, and, sometimes, delirium, coma, and collapse. The author has entirely abandoned the drug for chinosol, which is more powerful and unobjectionable.

APPARATUS, INSTRUMENTS, ETC.

The operating-table should be of simple construction. It should be made of enameled or galvanized iron, the top being constructed of plate glass. The author recommends highly the Boldt table. It is very convenient for



Fig. 117.—Patient in lithotomy position, cleansed and covered with sterile clothes, ready for operation.

all purposes. When the Trendelenburg posture is required, it may be obtained without any bending of the knees, the patient's shoulders resting against padded steel supports. It possesses another advantage, *viz.*, that the leg supports are attached to the table top, so that when the elevated lithotomy posture is required for the examination of the bladder and rectum, there is no disarrangement of the patient.

Some operators prefer to perform abdominal operations sitting at the lower end of the table, between the patient's legs, which are raised and held by supports; the best known table for this purpose is that devised by Frau Horn, and used by Martin, of Greifswald.

For operations on or by way of the genital passage the patient should be placed in the lithotomy position, her buttocks projecting slightly over the

end of the table. The legs may be held up by assistants, but it is more convenient to employ leg-rests fastened to the end of the table, or a special leg-holder, which is attached to the knees, and is held by a strap passed around the table.

The feet and legs of the patient should be covered with clean stockings and sterilized linen coverings. The patient's hips should rest on a piece of rubber cloth, or, better, on a circular rubber pad with a raised rim and a projection, which extends over the table-end into a collecting basin.

In private practice these operations may be performed on a convenient table, but sometimes it is necessary to place the patient on the edge of a bed. In such cases the knees may be held up conveniently by means of a walking-stick and bandage.

The stick is placed in the flexure of the knees, to which it is fastened by a bandage passed under the patient's neck or under the table. The instrument trays may be placed on small tables near the operator.

The lighting arrangements should be satisfactory both for abdominal work and for procedures carried out in the lithotomy posture. In a hospital operating room electric-light reflectors should always be in readiness. In many cases it is advisable to apply heat to the patient during operation. In hospitals provided with electricity a flat resistance coil covered with rubber sheeting may be used for this purpose, being placed under the blanket on which the patient's back rests; when this arrangement is not at hand, rubber bags containing hot water may be used. Too great attention cannot be given to the preservation of the temperature of the patient. Beside the reduction due to exposure, there is that due to the administration of chloroform and ether.

Stands and tables used for holding trays, basins, etc., should be made of metal with glass tops; the legs should rest on small rubber-tired wheels. Pitchers and basins should be made of white enameled metal. Filtered sterile water must be supplied in quantity, both hot and cold, in every hospital operating-room. The apparatus which provides this should be in or near the room. In private practice boiled water must be used.

In the hospital operating room it is very convenient to have a large reservoir of normal saline solution the temperature of which may be quickly changed. The following arrangement is convenient:

A cylindric copper reservoir, nickel-plated on the inside, is provided with a close-fitting cover with a rim which fits outside the cylinder. Within the latter is a coil about one inch in diameter, whose upper end passes through the side of the reservoir communicating by a T pipe both with the steam and cold-water systems. The lower end of the coil joins an escape pipe. Outside the reservoir is a thermometer the bulb of which passes through a hole in the side near the lower end. Under the reservoir is a bracket containing a number of gas-jets. On the lower portion of the side of the reservoir opposite the operating-table are two stop-cocks; to these rubber tubes may be attached for the conveyance of salt solution. The interior of the reservoir is sterilized by filling it with water and boiling it by means of steam circulating through the coil, or by the use of the gas-jets.

Sterile salt solution is placed in the reservoir, sufficient to last through several operations. By varying the amount of steam and cold water circu-

lating through the coil, the temperature of the salt solution may be altered. If no such apparatus be at hand, it is convenient to use a large pitcher with an attached thermometer, in which hot and cold sterile normal salt solution may be mixed until the desired temperature is obtained. Frequently a rough guess may be made by pouring the solution over the back of one's hand.

In making normal saline solution it is convenient to have ready flasks of a concentrated salt solution of known strength, which has been sterilized on three successive days. A definite quantity may be added to a definite amount of distilled water to make the correct strength (sodium chlorid, 6 gm. ($1\frac{1}{2}$ dr.); distilled water, one liter ($33\frac{1}{2}$ oz.).

Needles.—For passing ligatures a long-handled needle is of great value, especially in abdominal operations. It should be full curved, and the point should not be sharp. Different shapes are used. The needle may be in line with the handle, at right angles to it, or at an obtuse angle. The latter forms may be obtained with the needle attached on the right or left side of the handle. Some operators, however, prefer to use ordinary needles with needle-holders for all kinds of ligatures and sutures.

For ordinary suturing it is best to use needles with a needle-holder. The most convenient needles are the full-curved ones. The curve allows them

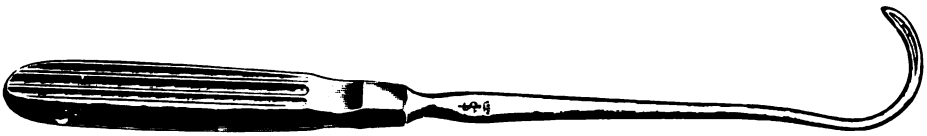


Fig. 118.—Deschamp's needle.

to be passed easily when working in a deep wound. Different sizes may be obtained, from the large ones used in suturing the abdominal walls after section, to the small ones used in suturing a wounded intestine. Various kinds of needle-holders are in use. The author prefers the pattern designed by Martin, of Greifswald. It is of very simple construction, slight compression of the handles causing the needle to be held firmly in the jaws, which are lined with copper.

Different Forms of Sutures.—*Separate Sutures.*—These may be passed in a single row, or there may be two or three rows, according to the depth of the wound.

Buried sutures should preferably be of catgut. In the closure of wounds the great desideratum is to bring the raw surfaces together accurately, without leaving spaces between them in which serum or clot may accumulate. The raw surfaces should be aseptic—they should not be injured by chemic reagents nor by mechanic means, *e. g.*, compression, bruising, in order that the resisting power of the tissues may not be diminished.

When, in any case, we cannot insure this exact closure of a wound, it is best to establish free drainage and to apply antiseptic dressings to the surface. Separate sutures are not so reliable in thoroughly closing deep wounds as the continuous suture.

Continuous Catgut Suture.—This suture is most valuable. It serves

not only to bring wounded surfaces together, but it is also a splendid means of checking hemorrhage. The gut is passed continuously by means of a curved needle, the full-curved form being most generally serviceable. In the case of a small wound, a single row of insertions of the suture may be sufficient; these may pass through skin and as much subjacent tissue as is incised. In starting the suture it is best first to close the upper skin angle of the wound by tying a knot; the short end of the suture is then cut away, and the long portion is held taut by an assistant. The wound is then gradually closed as the needle is passed through the skin surface, a quarter of an inch from the edge. After each passage of the needle the suture is pulled tight, and is held by the left hand of the operator or by an assistant.

When the needle is to be passed for the last time, there should be an end to the suture, of some length, projecting from the needle; this is held on the side of entrance, while the needle is passed completely. With the latter are two pieces of the gut, which are pulled tightly, and then tied to the single end on the other side of the wound. In making a knot the first turn should be double and the rest should be as in an ordinary reef-knot. Besides this, it is well to add a third part to the knot.

When a wide or deep wound is to be closed, the same method is employed in a series of stages, from the bottom of the wound to the skin surface. The needle is entered deeply, passing from side to side, bringing the lowest portions of the raw surface together, an assistant keeping the suture constantly tight. A second row is now passed with the same suture, bringing together the raw surfaces just above the level of the first row; third and fourth rows may be added if necessary. Finally, the edges are brought together at the surface.

In closing a deep wound some caution is needed in order that little cavities may not be left; nor must previously passed sutures be cut with the needle. If a suture is too short for the complete closure, it may be tied, and another one started, beginning by a knot near where the other ended. The whole process must be carried out with strict regard to asepsis.

Ligature en masse.—Sometimes it is necessary to ligate large masses of tissue, *e. g.*, omentum. Formerly it was customary to employ this method in the removal of diseased tubes and ovaries, the broad ligament being secured by a strong mass-ligature. This method is now very rarely employed. Lawson Tait's favorite ligature was secured by the Staffordshire knot as follows: after the tissue is perforated with a pedicle needle carrying a looped ligature, the needle is withdrawn and the loop is thrown over the mass to be removed, until it rests on the free ends. One of these is then drawn through this loop, so as to rest on it. Both ends are drawn tight, so as to constrict the pedicle. They are then tied, the first part of the knot having a double turn.

Bantock Knot.—When the needle is withdrawn, one of the free ends is carried around the pedicle, passed through the loop, and tied to the other free end on the other side of the pedicle.

Interlacing or overlapping ligatures may be used instead of these special knots.

Forceps.—Artery forceps and long tissue forceps are very greatly used and should be made with separable locks. The inner surfaces of the jaws

should not be finely serrated, in order that they may be easily cleaned. The pattern devised by Greig-Smith is a very safe instrument.

Hypodermatoclysis Irrigation Needles.—These should always be easily accessible and ready for use in every operating-room. The needle is a narrow, hollow metal tube, four or five inches in length, very sharp at one end, so that it may readily perforate the skin. The other end has a collar over which fits a rubber tube communicating with a reservoir of normal saline solution. Before the skin is punctured the fluid should run through the needle so as to force out the air. The injections are usually given in the subcutaneous tissue under the breasts or in the axilla or loin. It is sometimes advisable to give the injection under both breasts simultaneously. For this

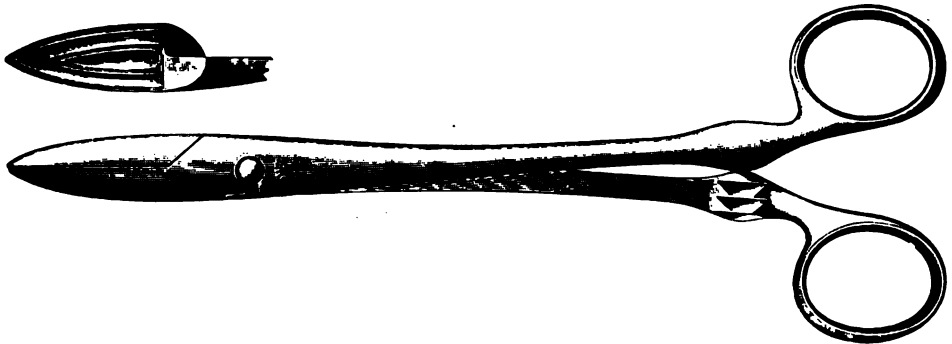


Fig. 119.—Greig-Smith's forceps.

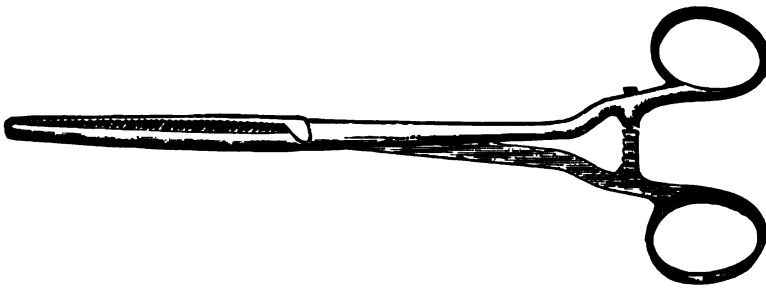


Fig. 120.—Pean's straight compression forceps.

purpose it is advisable to attach two needles by rubber tubes to a Y-shaped glass tube which is connected with the rubber tube leading to the irrigator. The fluid should have a temperature in the needle of 100° to 102° F. The needles are sterilized by boiling in soda solution.

ABDOMINAL SECTION IN GENERAL.

If the operation is not of the nature of an emergency, the patient should be carefully prepared during several days previous to operation. The state of the blood and urine and the various systems should be examined. The alimentary canal should be regulated. The patient should take plenty of sleep, and should avoid excessive strain or work.

The immediate preparation of the patient has already been described (see p. 217). Another reference to catheterization may here be made. In the early morning before operation the nurse should empty the patient's bladder by means of a sterile glass catheter, a strict aseptic technic being observed. The specimen of urine should be examined immediately. Afterward no further catheterization is necessary until the patient is on the operating table, when it is carried out by the assistant who cleans the patient. If, however, the operation is performed in the afternoon, the patient may use the bed-pan during the morning.

When the patient is lying in the dorsal position, resting on rubber-covered pads and clean sheets, her arms are extended on each side and the wrists fastened to the table with a strip of cotton. A clean blanket is wrapped around her chest, and another around her lower limbs. After the abdominal wall is cleansed (see p. 218), a sterile sheet is placed across the patient just above the field of operation and another just below it. Another sheet, termed "laparotomy sheet," with a mesial slit ten or twelve inches in length, is placed over the patient so that the abdomen is covered, the slit corresponding to the line of incision to be made. Over this is placed a sterile towel, about a yard square, with a mesial slit about five inches in length. Two sterile towels are then wrung out in normal saline solution and placed across the abdomen about five inches apart. Where each crosses the slit in the towel it is attached to the latter with a pair of forceps. By this means the edges of the slit are made to approximate during the operation, diminishing the risk of unnecessarily touching the skin adjacent to the incision.

Some operators fasten a sheet of thin rubber to the abdomen, cutting through it when the incision is made. Others use a large rubber sheet with a slit; attached to the edges of the latter is a flap of rubber which may be turned inward when the abdomen is opened, thus protecting the skin and edges of the incision from being touched.

The operator stands on one side of the patient,—usually the right,—his two assistants being on the other side. Near the operator is a basin of hot normal saline solution and a table on which are two trays containing the necessary instruments. One nurse attends to these and to the sutures and ligatures. Another nurse has charge of the swabs, pads, and towels, which are placed in sterile dishes on a table. Before the abdomen is opened she and the operator or chief assistant should count the gauze pads which are to be used during operation. All other pads and swabs should be removed so that the nurse may not make the mistake of passing them to the operator with the counted pads. During the operation, if it is necessary to add more pads, these should be counted by the nurse and the surgeon who counted the first lot. No pad should be divided during an operation, or removed from the operating-room. If the operation is aseptic, the pads may be washed in normal saline solution and used repeatedly. If infected areas are opened, each dirty pad should be thrown in a receptacle by the operator and not touched afterward.

Opening into the Peritoneum.—The patient may remain flat or may be placed in the Trendelenburg position before the incision is made. The author prefers the latter posture in the great majority of cases; it is not necessary in removing very large tumors. The mesial incision should always

be selected unless some particular reason exists for choosing another. It is accompanied with least injury, for no muscle, large nerves, or important vessels are divided. Sometimes a persistent umbilical vein may be cut, or one or more veins in the extraperitoneal fat. This incision may be employed for most purposes, as it affords equal access to both sides of the pelvis.

The objection sometimes made in regard to the mesial incision, viz., that it is apt to be followed by a weak line of union, is not to be entertained. If the incision be made and closed properly and there be aseptic union, the result is perfectly satisfactory. A vertical incision through the rectus muscles is preferred by some operators, but it offers no special advantage. On the contrary, if the outer part of the muscle be divided, the nerve-supply is apt to be interfered with.

The length of incision varies according to the nature of the case. A small incision may be temporarily enlarged by transverse stretching. In many cases an opening three inches in length suffices; frequently a longer one is required.

The author's procedure is as follows: The skin is divided by a mesial incision three inches in length.

The knife used is put away to be cleaned, and a fresh one taken. The superficial fascia and fat are divided, the bleeding from small vessels usually ceasing quickly. Forceps need not be employed unless there is persistent hemorrhage or the patient be very anemic; in the latter case it is important to prevent even small losses of blood. The junction of the sheaths of the recti (linea alba) is divided, and the edge of each muscle freely exposed. The fascia under the muscles is next divided, and then the extraperitoneal fat. The peritoneum is then elevated with two dissecting forceps held by the operator and an assistant, and is carefully incised with a knife. These precautions are necessary in order that no damage be done to the intestines or omentum. The obliterated urachus may be found in the middle line, and it should be pushed aside; it may sometimes be unobliterated for a distance, and may contain calculi, or may communicate with the bladder.

Ordinarily, when the slightest hole is made in the peritoneum, the bowels fall away from the surface, owing to the inrush of air; when, however, they are adherent to the parietal peritoneum, there is great risk of opening into them. In these cases, if the adhesions cannot be separated, it is necessary to close the opening in the abdominal wall, and it is justifiable to endeavor to make an opening at another part. If the bowel be cut, it should be closed with fine catgut sutures, passed through both the serous and muscular coats, the edges being turned in toward the lumen of the bowel.

Sometimes it is difficult to recognize the peritoneum; it may be very thin, and the extraperitoneal fat may be mistaken for the omentum. When there is much ascites, the peritoneum may project and be mistaken for a thin cyst-wall; when there are many adhesions to it, or if it be very much thickened by inflammation, it may be difficult to distinguish.

The omentum may easily be pushed aside unless adherent; if the latter complication exists, it should be carefully separated from the abdominal wall, and pushed to one or other side. Bleeding vessels in it may be ligated, or portions may be sutured *en masse*. Sometimes it may be necessary to cut through the omentum, tying the vessels. Bowel adhesions, if

recent, may be broken by means of the finger or swabs; when long enough, they may be tied in two places and divided. Sometimes they are short and strong, and require to be cut with knife or scissors.

When the peritoneum is successfully opened, a finger should be passed through the incision so as to protect the intestine, while the rest of the peritoneum is cut with a pair of scissors to the desired length. Two or three fingers are then introduced, in order that the condition of the pelvis may be determined; sometimes the whole hand may be used.

In many cases it may be necessary to enlarge the incision considerably in order to deal satisfactorily with the internal condition.

When extending the opening higher than the navel, the knife should not pass through the latter, but on one side of it. In dividing the tissues near the symphysis pubis care should always be taken to prevent the bladder from being injured; if it be cut, the wound should be closed with a continuous catgut suture.

The omentum and intestines should be pushed upward into the abdomen, and held in position by large gauze pads which have been wrung out in hot normal saline solution. They act as a barrier during the operation, preventing exposure of the intestines, and absorbing fluids which may escape. It is advisable to attach forceps to the tapes fastened to the pads, allowing them to rest on the sterile sheets. If this practice be followed in connection with all pads placed in the abdomen during operation, the risk of leaving a pad in the cavity is reduced to a minimum.

Poten has introduced the following procedure for the protection of the general peritoneal cavity. It is applicable only to cases in which the high Trendelenburg position is used. The ordinary mesial incision is made in the abdominal wall as far as the peritoneal layer, but not through it. The latter is then separated from the wall on each side, and a transverse incision is made through it above the bladder. The peritoneum above this hangs as an apron and, after the intestines are pushed upward, it is stitched to the posterior pelvic wall, thus shutting off the general peritoneal cavity from the pelvis. At the end of the operation the stitched flap of peritoneum is released and the incision closed transversely.

The methods of dealing with the various diseased conditions which may be found will be considered in succeeding chapters. Blood and other fluids which escape during operations should be removed with gauze pads at once, care being taken not to rub the peritoneum. Rough handling of the peritoneum must be avoided to diminish the risk of after-formation of adhesions. It should not be allowed to become dry from exposure to the air, for the same reason; it may be moistened from time to time with normal saline solution at a temperature of 104° to 108° F. It is, indeed, very important to keep up the temperature of the peritoneum during an operation, for exposure to cold lessens its resisting power and increases the liability to the formation of adhesions. Turk advises the use of thin, sterile rubber bags filled with normal saline solution (105° F.) and placed inside the abdominal cavity during operation. All procedures should be carried out rapidly in order to lessen the time of exposure.

Hemorrhage from recognizable vessels must be checked by catgut ligatures. Oozing from raw areas may sometimes be troublesome, but is usually checked

by the pressure of pads soaked in hot normal saline solution; sometimes it is necessary to apply the Paquelin cautery at a dull red heat. Before closing the abdomen in cases in which considerable blood has escaped, it is advisable to irrigate the abdominal cavity with normal saline solution at a temperature of 105° F.

There has been considerable difference of opinion as to the composition of physiologic salt solution. As Matthews points out, it is not possible to make a perfect solution, but only one sufficiently accurate as to be most suitable. The solution in general use contains too little sodium chlorid—0.6 per cent. A 0.9 per cent. solution is much nearer the osmotic blood-pressure. Matthews suggests the following composition:

Sodium chlorid,.....	0.90 per cent.
Potassium chlorid,.....	0.03 “
Calcium chlorid,.....	0.02 “
Distilled water,.....	100.00 “

A half a pint or more may be left in the cavity. The blood is disseminated through the fluid, and the latter is gradually absorbed during the hours following the operation. This procedure has also been recommended by Clark in cases in which pus or cyst or bowel contents may have escaped into the peritoneal cavity. After careful sponging, thorough irrigation is carried out and a considerable quantity of the fluid is left in the cavity when it is closed. Only in cases in which the peritoneum has been extensively contaminated or general peritonitis has started is drainage necessary.

Clark emphasizes the importance of thorough irrigation on the ground that, even if the foreign matter be not entirely removed, it is more broken up and, therefore, more easily disintegrated by the leukocytes. Muscatello's experiments have clearly demonstrated that the leukocytes act more rapidly in removing foreign particles when they are small. Moreover, the irrigation distributes the noxious matter and prevents it from remaining in a localized area.

The salt solution also leads to the outpouring of leukocytes into the peritoneal cavity, thus increasing the defensive power of the peritoneum against infective material. Recently it has been recommended that intraperitoneal injection of this solution be carried out before operation, in order to increase the resisting power of the organism. Mikulicz has experimented on animals with various other solutions, *e. g.*, bouillon, nucleic acid, and has obtained the most marked hyperleukocytosis with the latter material. He has also used nucleic acid in human beings, injecting 50 c.c. of a 2 per cent. solution subcutaneously twelve hours before operation. The injection always caused local redness, tenderness, and slight swelling for a day, with slight rise in temperature, and, sometimes, slight rigor and vertigo. It was interesting to note that hypoleukocytosis always preceded the hyperleukocytosis for an hour or more. It is too early to give any opinion as to the value of these methods, long and careful study being yet necessary.

Irrigation may be carried out by means of a sterile rubber tube connected with the reservoir containing the salt solution. The stream should flow gently, and should not be directed against the diaphragm. Neither should the cavity be too much distended. Dyspnea, asphyxia, or cessation of breathing may occur if caution be not observed. The patient should be flat during irrigation.

Drainage of the Peritoneum.—Within recent years drainage has been much less practised than it was formerly. Clark's work has been to a considerable extent responsible for the change. In regard to operative cases, in which there is no primary infection, he emphasizes the following points, namely, that blood within the peritoneal cavity may be absorbed before it coagulates; that after coagulation it may be removed gradually by the action of leukocytes or may become encapsulated and organized; that the absorptive power of the peritoneum is most marked when the tissues are uninjured, but that, even when considerably injured, free blood may be taken up; that where the peritoneum has been injured, especially if already diseased, there is a special tendency to the pouring out of blood and serum; that freshly effused blood or serum is actively germicidal for some time, and may be able to destroy many organisms. He has shown that in 100 undrained cases, where there were extensive adhesions, only one was complicated by suppuration after operation, whereas in 100 similar cases which were drained it occurred in eight.

The introduction of a gauze drain into a raw, oozing cavity may check the bleeding, but leads to free serous secretion, which is liable to infection from the skin of the abdominal wall. The danger of infection through a drainage tract is greater after the drain is removed than immediately after the operation. When a drain is introduced, plastic fibrin forms round about it, causing adhesions to neighboring peritoneum. If the gauze be removed in this period, great pain is caused, and complications may result, *e. g.*, dragging out through the wound of omentum or intestines, hemorrhage from rupture of a vessel, or separation of a ligature. As the fibrinous covering organizes, it becomes less attached to the drain, owing to degeneration of the layer next the drain. From the fifth day this takes place, so that removal of the gauze is more easily carried out after that day. In removing the drain the organisms which may have entered the outer part of the gauze may be squeezed into the peritoneum, and thus set up infection.

In cases where infectious matter is supposed to exist at the time of operations, *e. g.*, pyosalpinx, ovarian abscess, etc., the researches of Miller and others have proved that the great majority of fluid collections are sterile, and Clark shows that the results of treatment in such conditions are very much more satisfactory where no drainage is employed. Drainage is often associated with obstinate constipation, tympanites, nausea, and vomiting, owing to the constrained position of the intestines around the drains. Fecal fistula may also be produced. Sometimes the inflammatory reaction around the drain may cause vesical irritation, cystitis, and dysuria; the bladder may be interfered with in its movements, or a suppurating tract may open into it.

Cases in which drainage is employed are more apt to be followed by hernia than those in which no drainage is used. In order to avoid the necessity for drainage, Clark insists that careful attention be paid to the following points:

1. Thorough disinfection of the hands of the operator and his assistants.
2. The careful control of hemorrhage.
3. The avoidance of bruising and injuring of tissues.
4. The isolation of the general peritoneal cavity during the operation.
5. The sacrifice of as little as possible of the peritoneum.

6. The conservation of bodily heat.
7. The avoidance of rupture of intraperitoneal abscesses.
8. Irrigation of the peritoneal cavity with normal salt solution after operations, where débris or normal fluids escape into the peritoneal cavity.
9. The retention in the peritoneal cavity of 500 to 1000 c.c. of normal salt solution after operations which have been prolonged, or in which the presence of septic matter has been suspected. This should be associated with the elevation of the foot of the bed for twenty-four hours after the operation, in order that the matter should not collect in one part, namely, in the pelvis, but should be distributed through the peritoneal cavity, so that the forces which are employed in removing the foreign matter may act to the best advantage. Irritating toxins are thus diluted, and more leukocytes will be brought into relationship with the foreign material.

This postural drainage is only to be regarded as a prophylactic against postoperative peritonitis, and is not to be used when peritonitis is already established. In purulent peritonitis it is of no use, for Pawlosky has demonstrated that in this condition the lymph-channels leading from the peritoneum are choked with microbes and inflammatory products; free drainage through an incision is better in such cases. Where ascites is present, it is also best not to employ the postural method, Waterhouse having shown that absorption from the peritoneal cavity is imperfect where that condition exists. Neither is it advisable in cases in which blood-clot, fibrin, portions of an ectopic ovum, or thick cyst contents have been for several hours disseminated in the peritoneal cavity.

In a recent paper Clark and Norris have published an account of observations and experiments which support strongly the earlier views of the former.

In experimenting as to the fate of minute sterile granules of India ink and carmin placed in the peritoneal cavity, they found that these were carried through the diaphragm into the retro-peritoneal lymph-channels, being widely distributed. Within eight hours they were found in the marrow of long bones, liver, kidneys, lungs, etc.

On injecting infectious micro-organisms or irritants into the cavity, there is an increased flow of lymph and leukocytes into the cavity, varying according to the degree of irritation. This is followed by their passage into the general circulation. The omentum plays an important part in providing for the supply of serum and leukocytes, its vessels being numerous and thin-walled. The examination of the blood after abdominal operations reveals increased leukocytosis. Though this may be partly due to the anesthetic, it is also due to the traumatism of the operation. C. Y. White has found that the postoperative leukocytosis averages somewhat over 20,000.

When drainage is used, the leukocytosis persists longer. When normal saline solution is placed in the cavity, the average leukocytosis is higher during the first twenty-four or thirty-six hours. In cases in which infective material is present, the salt solution, therefore, exercises an additional beneficial influence by causing a greater number of the cells to enter the peritoneal cavity and attack the micro-organisms.

Clark and Norris have made a very interesting series of experiments in inoculating the peritoneum with virulent cultures of organisms, followed by the introduction of normal saline solution, and have shown that the latter undoubtedly minimizes the risk of infection. All control animals in which no salt solution was used died, whereas of the test animals in which it was used 44 per cent. were saved, and the duration of life in those which died was longer than in the control animals which died.

The Treatment of Denuded Peritoneal Surfaces in Abdominal Operations.—One of the most important advances in the surgery of the abdominal cavity in recent years is the increased attention given to the preservation of the peritoneum from such damage as may lead afterward to adhesion formation and to intestinal obstruction. The older operators were too frequently content with the removal of the disease without much concern for the con-

dition of the parts left behind. For example, after the removal of ovarian or tubal swellings, the end of the stump was left raw and exposed, ready to adhere to the nearest structure. Adhesions were torn through, the tumors shelled from their beds without care for the newly denuded tissue, except as regards the checking of hemorrhage.

At the present time such neglect must be considered as reprehensible in the highest degree, since it subjects the patient to increased risk of after-suffering from adhesions and of danger from intestinal obstruction.

In many cases, unfortunately, raw surfaces are in such a position or so large or numerous that it is not possible to obliterate them. But in many instances they are of such a nature as to be rendered practically harmless.

Small patches on the parietal peritoneum, the bladder, and the broad ligaments may often be covered by loosening the peritoneum around them and bringing the edges together with catgut. Similar surfaces on a mesentery may be quickly closed by a continuous suture. Areas of omentum which have been freed from adhesions should never be left free. If slight, they should be covered with neighboring healthy omentum by means of catgut. If extensive, they should be ligated near their base and then cut away. The common practice of leaving such omental stumps bare is a bad one; they should be turned up and buried in healthy omentum by means of a continuous suture. In this way there is little chance that they will adhere to neighboring structures.

Raw surfaces on the intestine may be covered by the use of a continuous catgut suture when they are of very small size. When they are large, they cannot be treated in this way, because of the risk of constricting the lumen unduly. Such conditions are often very unsatisfactory, as are large, raw surfaces on the outer part of the mesentery. In some instances it is advisable to detach a flap of parietal peritoneum from the abdominal wall near the incision, if the peritoneum is very lax. When it is not, a thin flap may be removed from the omentum and stitched to the raw surface on the bowel with fine catgut. The gap in the omentum is easily closed with catgut. In very bad cases it may be advisable to resect the affected portion of the bowel, especially if much of the muscular layer be bared. On the uterus small areas may sometimes be covered by means of a running suture. If, however, the patches are large or numerous, transplantation of grafts of peritoneum or omentum may be tried. When this cannot be carried out, the raw areas may be cauterized so as to form a black, charred surface, since the latter is less likely to become adherent than a raw, oozing area, the dead char acting as a protection to the subjacent living organizing tissue. I have operated a second time on several women, in whom I had previously cauterized the posterior uterine surface after freeing it from adhesions, and have been surprised at the small number of fresh adhesions present. Adhesion bands should always be cut or cauterized close to their attachment, the stump being buried, where possible, under neighboring peritoneum. A thick char cannot be produced on the bowel, for the latter can be only lightly touched with the cautery. Various membranes have been recommended for the purpose of covering raw areas, *e. g.*, catgut, gold-beater's skin, prepared animal peritoneum, but the author has had no experience with them.

In removing diseased tubes or ovaries, the old-fashioned method of

massing the tissues together in a ligature, outside of which the tissues are divided so that a raw stump is left projecting into the peritoneal cavity, should be abandoned. It is much more satisfactory to ligate vessels independently, and, after removing the diseased tissues, to cover all raw areas with peritoneum.

If the ovary alone is to be removed, it is simply cut away at the hilum, the raw surface on the back of the broad ligament being constricted and covered by a double row of continuous catgut. If the tube is to be removed, a similar procedure is carried out, the uterine end of the tube being cut out of the wall of the uterus to the depth of a quarter of an inch, or burned out when there is any possibility that it is not sterile.

When the ovary and tube are to be removed, a ligature is placed around the upper part of the infundibulopelvic ligament to secure the ovarian vessels, and another around the upper part of the broad ligament close to the uterus, below the tube, to secure anastomosing branches of the uterine vessels. The ovary and the tube are then removed, the inner end of the latter being cut out of the uterine wall as above described. The raw area of the broad ligament and uterus is then closed and covered with peritoneum by means of continuous catgut suture. After this method there is little chance that the broad ligament will adhere to surrounding tissues.

In performing vaginal extirpation of the uterus the ligated ends of the broad ligaments should be drawn downward and stitched into the lateral fornix, so that the raw stump remains entirely within the vagina.

Within the last few years I have carried out the following plan in many cases in which double tubal or ovarian swellings have been adherent in the pelvis behind the uterus. When such masses are removed, the area of the pelvis to which they were attached is left raw and oozing, the extent varying in different instances.

In marked cases, in order to cover the raw surfaces, I have, after ligation of the ovarian and uterine vessels, removed the diseased swellings and the entire uterus with the exception of its anterior peritoneal layer. This is left continuous with the broad ligaments, bleeding points on the cut surface of the peritoneal layer and of the vagina being secured. A strip of gauze is passed into the vagina, its end resting in the pelvis just above the opening in the fornix.

The broad ligament, with the intervening uterine peritoneum, thus forming a flap extending across the pelvis, is turned backward and stitched to the rectum and posterior pelvic wall, so as to form a new covering for the pelvic floor. This same procedure may be carried out after removing bilateral broad-ligament tumors where a large, raw area is left in the pelvis.

After these operations there is always some oozing of blood into the vagina, but not to any marked extent. The gauze may be removed on the second or third day, according to the amount of discharge, and a fresh piece inserted, or vaginal antiseptic irrigation carried out daily.

Drainage.—The conditions in which drainage is indicated will be mentioned in connection with the various diseased structures described in succeeding chapters. In general it may be stated that it is chiefly in localized or general purulent peritonitis, when foreign material, *e. g.*, bowel or dermoid cyst contents, has been extensively or for several hours dissem-

inated in the cavity, or when a portion of an infected cyst-wall or pus-sac cannot be removed from the pelvis.

Drainage may be carried out through the abdominal wall, through the vagina, or by both routes. The choice should always be given to vaginal drainage, for it must be remembered that abdominal drainage is very apt to be followed by a weak cicatrix. Vaginal drainage is obtained by incising the posterior fornix through the pouch of Douglas (the vagina having been cleansed before the operation). The end of a strip of chinosol gauze is passed into the vagina, and the remainder is packed in the cavity of the pelvis. It should be saturated with normal saline solution. On the third or fourth day after operation it may be removed through the vagina by placing the patient in the lithotomy position, and a smaller fresh piece may be reinserted for two days longer.

When the latter is removed, a vaginal antiseptic douche may be given daily. Some operators use a T-shaped rubber tube for draining the pelvis through the vagina. When abdominal drainage is carried out, a strong glass tube with small perforations in the sides may be used; the inner end usually rests in the pouch of Douglas, passing between a couple of sutures close to the lower end of the abdominal incision. The outer end of the tube should possess a circular flange, which should not project much beyond the skin.

If the tube be too short or have no circular flange, it may slip into the abdomen; if too long, it is apt to be forced inward upon the viscera, and may injure a portion of intestine.

The sutures are all tied, except one next the tube, which is left to be tied when the tube is withdrawn. The skin-edges around the tube may be kept from gaping by horse-hair sutures. The dressings in such a case are best applied as follows: A square piece of thin india-rubber sheeting is perforated and fastened to the tube just below the flange. Under it several layers of gauze dressing are placed. By this arrangement fluid escaping from the tube does not soak the dressings next the wound. Over the tube-mouth a pad may be placed, and the whole covered with absorbent wool, and kept in position by means of an abdominal binder, which must not be fastened tightly. The tube may be continuously drained by a piece of antiseptic gauze passed into its lumen. Generally it is best to withdraw the fluid by means of a syringe, with a rubber tube attached, as often as necessary.

Sometimes after an operation the dressings may require to be changed frequently, but the intervals should be made as long as possible. When capillary drainage is established, it is apt to be checked by clots if the discharge is bloody. They may be removed by means of a syringe attached to a piece of rubber tubing, or by a sound covered with sterilized cotton.

If the tube be left in position for twenty or thirty hours or more, it tends to become inclosed in peritonitic adhesions. This is sometimes valuable where there has been a tear in the rectum in the removal of a mass from the pouch of Douglas which has not been well closed during the operation. The fecal matter and gas escape through the tube-tract without infecting the general peritoneal cavity. This fecal fistula may last a long time.

When intestine has been wounded, gas or fecal matter may pass from the tube, and this may be the first intimation that the accident has taken place

In some cases air escapes from the tube, having entered the peritoneal cavity during the operation or having been sucked in afterward during attacks of vomiting.

If the holes in the sides of the tube are larger than 1 mm., the omentum (rarely, the bowel) may tend to work its way into the lumen. A series of little hernias may thus form, which, becoming strangulated, may give rise to pain, vomiting, local hemorrhage, or gangrene. This may occur within the first twenty hours after operation. To prevent it the tube should be turned around and moved slightly up and down, when the dressings are changed.

If the tube should become fixed by the formation of the hernias, rotation may cause the withdrawal of them. But it may be necessary to pull up the tube in order to ligate the omentum outside the hernias so that the latter may be cut away.

The drainage-tube may be required only a few hours, or it may be needed for several days. It should be removed when the discharge becomes scanty. The longer it remains in position, the greater the risk of an abdominal hernia. The edges of the tube-tract are slow in healing. When it is withdrawn, the suture which was left untied is securely fastened and a small rubber tube is inserted; the whole wound is then freshly dressed. During the following days the rubber tube is gradually shortened.

In some cases, *e. g.*, when a large ectopic gestation sac is to be drained, gauze alone may be used, being carefully packed from the bottom of the sac to the skin. The author always employs chinisol gauze for such a purpose.

Mikulicz's plan is to make a long sac of iodoform gauze, which is placed in the part of the cavity to be plugged. To the bottom of the sac a long piece of string is previously fastened. It is brought out through the opening of the bag. The sac is then packed with a series of strips of gauze. The order in which the strips are placed in the sac should be marked by strips of colored yarn attached to their outer ends. They should be removed in the reverse order of their introduction. It is an advantage also to place a glass or rubber tube in the very center of the mass. All excess of iodoform should be removed from the gauze beforehand by beating it, in order to lessen the danger of absorption.

The tampon is left in position according to the amount of oozing. It is impossible to lay down exact rules. Mikulicz states that the gauze packing may be removed after forty-eight hours, and the sac later. Fresh gauze may be introduced if necessary. The necessity for this method of drainage very rarely arises. The author does not recommend iodoform gauze, because of the risk of absorption: chinisol gauze is much safer.

Closure of the Abdominal Incision.—Of all the methods in common use, the following is the one which has given the author the greatest satisfaction: The peritoneum is closed with fine catgut, the edges being everted so that no raw tissues may be left next the cavity. A series of guttapercha silk or strong silkworm-gut sutures are then passed through the skin, fascia, and recti muscles, about three-quarters of an inch apart. Each of these is passed with two full-curved needles. One of the latter is inserted under the rectus and is carried through it, the anterior layer of the sheath and the skin emerging about a quarter of an inch from the edge of the latter; the other

end of the suture is carried through the opposite side of the incision in a similar manner. This plan is preferable to the method generally employed of using one needle, which is carried through the skin on one side, down through the deep tissues, and out through the skin on the other side. As the cleansing methods may not suffice to remove all micro-organisms from the deep layers of the skin, a needle passed in this manner may carry infection from the skin into the deeper tissues.

When these sutures are passed, a few interrupted formalin catgut sutures are used to approximate the edges of the fascia anterior to the recti muscles. The silk or silkworm-gut sutures are then tied. If the skin-edges are not well apposed between these, they may be brought together with horse-hair.

An old method still very much employed consists in passing the sutures through the entire thickness of the wall. This is not so satisfactory as the one already described, because it does not insure such exact closure of the peritoneal layer, and consequently there is more risk of adhesions along the line of the wound. Moreover, if stitch infection occur, the organisms may extend to the peritoneum.

The method of closing the incision, layer by layer, with buried catgut has been somewhat practised, but while it may usually be very satisfactory,

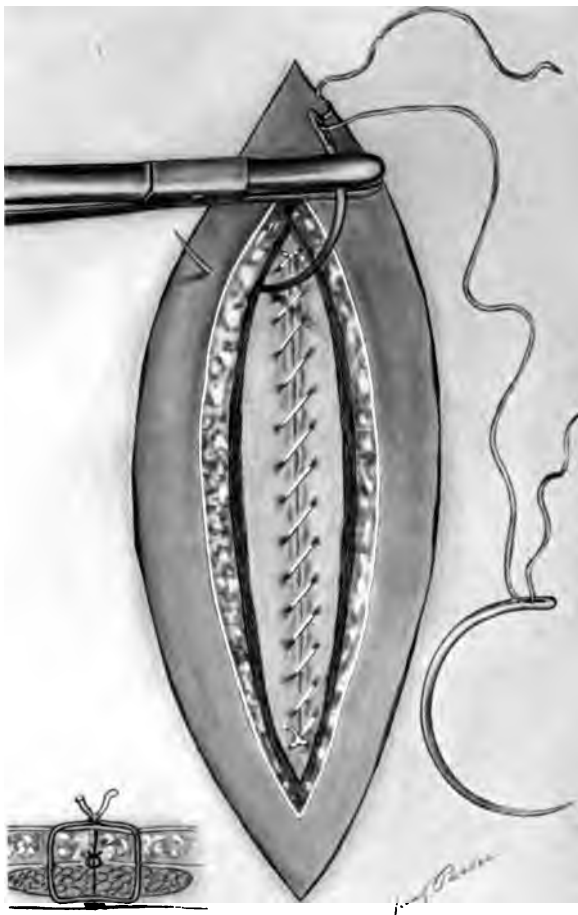


Fig. 121.—Closure of abdominal wall incision. The peritoneum is closed with fine catgut; silk sutures are then passed through the rest of the wall. The lower small illustration represents the condition after closure.

it may occasionally lead to a bad closure, as a result of imperfect sterilization of the catgut or infection of the wound in some other way. The incision in such a case may open to a considerable extent and may not heal for a long period.

The Dressing.—After the wall is cleansed with alcohol, a thin pad of chinosol gauze is placed on the wound. This is covered with a single piece of gauze larger than the pad. The edges of the gauze are fastened to the skin with antiseptic collodion; in this way the dressing next to the wound cannot be disturbed. Antiseptic collodion is made as follows: Mix ether and absolute alcohol in equal quantities. Then dissolve in this sufficient biniodid of mercury to correspond to a strength of 1:5000. Add pyroxylin until the fluid is syrupy.

Over the collodion dressing pads of sterile gauze are placed. These are held in position by strips of adhesive plaster fastened to the skin. Over this broad gauze or a cotton pad is placed, being held by a broad abdominal binder or a Scultetus bandage.

The patient is then placed in bed, a clean night-dress being put on if the one worn during the operation has been soiled. The bed should be well warmed with hot-water cans, which must be separated from the patient by blankets to prevent burning of the skin by direct contact. Where electricity is available, heat may also be supplied by means of a flat resistance coil covered with thick rubber cloth placed under a blanket beneath the patient.

In cases in which salt solution has been left in the abdomen, the lower end of the bed should be raised about ten inches for ten or fifteen hours. This position is also advisable for a longer period when the patient is very anemic.

After-treatment of Abdominal Sections.—The patient lies at rest on her back or side. For the first twenty-four or thirty-six hours no food should be given by the mouth. If it be necessary to feed early, it is best to do so by the bowel. She must be encouraged not to drink, but may be allowed to rinse out the mouth.

Sips of hot water may be given if the patient is very thirsty. Cold water and ice should not be allowed. When there is extreme thirst, a high rectal injection of a pint of normal saline solution (102° F.) often gives marked relief. This is best retained when the foot of the bed is elevated. If the patient progresses well and is not sick on the evening of the second day, a little milk and hot water, or milk with lime-water, may be given in sips. When milk cannot be taken, plasmon solution may often be retained; it may be boiled in water, chicken- or beef-tea. Ginger ale is often appreciated. The white of raw eggs mixed with water (1 dr. to 1 oz.) and a little sugar and flavored with lemon or orange-juice or sherry is usually palatable. This dietary is continued during the next day; during the fourth day tea or coffee, chicken- or beef-jelly, gruel or arrowroot, may be added. During the night one or more of the same articles may be given. On the fifth day toast, chicken-broth, eggs, and milk-pudding may be added; on the sixth day, fish; on the seventh and succeeding two or three days, chicken may be added to the dietary. Gradually, afterward, an ordinary light mixed diet is adopted.

There may be nausea after the operation; it may last for twelve, eighteen, or twenty-four hours, or may be more prolonged. The inhalation of acetic-

acid vapor has been considerably recommended as a means of diminishing the sickness. If marked, the administration of food and fluid by the mouth must be postponed.

Bismuth and hydrocyanic acid mixture, sips of champagne, or a hot aqueous solution of sodium bicarbonate (5 gr. to 1 oz.) given in the dose of a couple of tablespoonfuls, may give relief. Cold black coffee or sherry (20 drops in a tablespoonful of soda water) may often be retained. A mustard leaf over the epigastrium may sometimes be beneficial. When there is marked vomiting, it is advisable to wash out the stomach.

Sometimes a hypodermatic injection of morphin will check the vomiting, but should be used only as a last resort.

In long-continued vomiting, where the patient is weak and requires food and stimulants, nutrient enemata may be given. The following is a good mixture: Peptonized milk, 1 oz.; brandy, 1 oz.; the whites of two eggs; add a little salt.

Or a mixture of peptonized beef-tea with brandy may be given. Somatose is also valuable. If necessary, *strophanthus*, *digitalis*, or other drugs may be added to these.

Before nutrient enemata are given it is well to wash out the rectum with warm salt solution. It is the author's practice to alternate high rectal enemata of normal saline solution with low rectal enemata (4 oz.) every six hours. When the latter are not retained, the nutrient elements are added to the saline solution and the latter alone administered. Nutrient suppositories are also used.

As regards the bowels, nothing usually passes except flatus for several days. If gas tends to collect and causes the patient any annoyance, a rectal tube should be passed to enable the flatus to escape. Enemata containing soap-suds or turpentine may also be given for this purpose. Recently, sulphate of eserine has been recommended in order to help the normal action of the intestines and to diminish vomiting after operations.

If all goes well, a laxative dose may be given the evening of the third day, castor-oil, licorice, or mild salines being used. On the following morning a high soap-suds enema should be given. Many operators give calomel and salines in order to produce free purgation. This is not, however, necessary, and often produces undesirable distress and weakness. If there be much flatulence, the laxative may be given at an earlier period.

An effort should also be made to produce an evacuation of the bowel earlier than the third day by an enema of soap and water (1 pint), to which may be added, if desired, an ounce of Epsom salts, or this may be preceded, an hour before, by warmed olive-oil or glycerin (6 oz.). A small quantity of turpentine is often very valuable when added to an enema. On succeeding days mild laxatives may be required to regulate the bowels, and enemata may also be necessary.

After the first opening of the bowels, if the patient feels exhausted, a dose of brandy or whisky may be administered.

The bladder should not be emptied with a catheter unless absolutely necessary. Early in the evening after operation the patient should try to urinate, the foot of the bed being lowered, if it had been previously raised. If she fails, the nurse should place a hot moist cloth over the vulva or should

pour a hot antiseptic lotion over it. If urination is still impossible, the nurse must use a glass catheter under strict aseptic precautions.

A sterile glass catheter should be placed in a sterile basin and taken to the bedside. The patient's knees having been drawn up and separated, the vulva should be exposed to a good light, natural or artificial. The nurse's hands should be cleansed as for an operation, or she should wear sterile rubber gloves. With the fingers of one hand she separates the labia, and with the other sponges the vestibule with gauze soaked in alcohol or warm sterile water containing formalin (20 drops to a pint). The outer end of the catheter is then taken in the fingers of the other hand, and the point carefully and gently inserted through the urethra into the bladder. The urine should be caught in a vessel placed on the bed.

This procedure may be necessary at intervals of five or six hours for one or more days. The slightest carelessness on the part of the nurse may lead to infection of the bladder and consequent cystitis. It is important to measure all the urine voided during the first twenty-four hours after operation, or for a longer period in some cases.

Pain is generally felt in the pelvis after sections. It varies greatly in intensity in different cases, is not dependent upon the seriousness of operation, and is usually exaggerated in very nervous women. It is usually considerably lessened the day following operation, and gradually passes off within the next twenty-four hours. It is aggravated by vomiting. Other pains may be due to localized infection in the abdominal wall or pelvis, blood extravasation, flatulence, neuralgic conditions in weakly women, and sometimes peritonitis. It must be remembered that there may be little or no pain with general septic peritonitis following an abdominal section. In the relief of pain sedatives must be given sparingly, and the patient should be encouraged continually. Dionin, heroin, codein, or morphin may be required, but the free use of the latter drug is inadvisable because of its inhibiting action on the intestines and emunctory organs.

Restlessness is sometimes very marked, but may be to a great extent dispelled by the attentions of a tactful nurse. Sponging of the limbs and chest with warm alcohol or with warm soap and water may be carried out daily after forty-eight hours, if the patient be not too ill; after each part is sponged it should be dried and covered, and there should be no exposure leading to a chill. Excessive restlessness may, however, require a hypodermatic injection of codein or morphin, or an enema of paraldehyd (2 dr.) in syrup and water, or of sodium bromid (1 dr.) in milk of asafetida (1 dr.).

The pulse after operation, if the case proceeds well, is slow and regular. It may be quickened by internal hemorrhage, peritonitis, and various other conditions, *e. g.*, restlessness, nervousness, mental excitement, etc.

The temperature in an ordinary case usually rises in the evening of the day of operation, and afterward gradually falls to the normal, where it remains. It may be subnormal where there has been much shock or depression or where marked internal hemorrhage has occurred. It may be elevated by various conditions, *e. g.*, disturbed stomach, tympanites, nervousness, infection, formation of a hematoma or hematocele, etc. There may be a very marked rise of the temperature in peritonitis, though in some cases it may not be elevated or only to a slight extent.

The tongue in normal cases is moist, normal in color, and only slightly furred or not at all. It may be coated from a disordered stomach or may be stained light brown from bilious vomiting. In peritonitis it may present various appearances. It may be covered with a yellowish coating, or may be rough and dry. Where marked suppuration exists, it may be dry, smooth, and of a bright red color.

The occurrence of tympanites must be regarded with anxiety. It causes pain and distress, and may quicken pulse and breathing, interfering with the action of heart and lungs. It is most frequently due to intestinal paresis resulting from the shock of operation and intestinal fermentation. It is, however, very often one of the earliest indications of septic peritonitis, and, in such a condition, usually appears on the third day. Tympanites occurring after the removal of large tumors is usually painless. To relieve the distention a long rectal tube may be inserted into the bowel and left there for fifteen minutes at a time. Various high enemata are also serviceable, *e. g.*, solution of soap-suds or the following mixture:

Turpentine,.....	3ss
Warm olive-oil,.....	3ij
Warm water,.....	Oj.

In mild cases essence of peppermint (15 drops) or tincture of capsicum (1 or 2 drops in a little warm water) may be given by mouth every half-hour with satisfaction.

The abdominal wall stitches may be removed about the tenth day in ordinary cases. If the patient be very stout, pregnant, or has a cough, if the incision is very long or infected, or drainage has been employed, they should be left in position several days longer. On the evening before the day of their removal the abdominal dressings should be removed and a gauze dressing soaked in formalin solution (formalin, 20 min.; glycerin, 4 oz.; sterile water, 16 oz.) should be placed over the wound, covered with protective or oiled paper. Over this gauze dressings are fastened with a binder. At the same time an aperient should be given so that the bowels may move the next morning (with or without the aid of an enema) before the stitches are removed.

On the morning of this day is also a convenient time to change the patient's night-dress and the bed-linen, because, after removal of the stitches, it is necessary that she should be kept very quiet.

Before removing the sutures, the line of the wound and the suture ends are carefully washed in antiseptic lotion. Each stitch is removed by means of forceps and scissors. The knot is pulled outward, the skin depressed a little by the scissors, the suture cut below the skin-level and drawn out of the wall by the forceps which are attached to the knot. If the wound is clean, chinosol gauze is placed along the line of the incision and over this several layers of sterile gauze. Across this are placed strips of adhesive plaster, the abdominal walls being well drawn toward the middle by an assistant before the plaster is applied. If no suppuration occur, this dressing need not be changed for several days.

If stitch abscesses have formed, dressings soaked in the above-mentioned formalin solution must be applied for two or more days. The stitch openings must be kept large enough to allow the pus to escape.

By the sixteenth day the patient may be allowed to sit up in bed. After two or three days, if all goes well, she may be allowed to sit up in a chair for a time and, on the following days, to walk somewhat. Before being allowed up she should be fitted with an abdominal belt, which should be worn when she is out of bed.

About the twenty-first day the patient may go home. She must be told to avoid all exertion, to be careful with her diet, to keep the bowels regular, to avoid coitus for four months, and to wear the belt for six or eight months. If the abdominal incision is very long or if it has been infected, the belt should be worn for a year.

Complications after Operation.—*Shock.*—After most cases of abdominal section there is some depression, the patient being pale, the pulse small, soft, increased in frequency (sometimes slow). Sometimes shock is a very marked feature; it is generally due to lengthened anesthesia, hemorrhage, reduction of temperature from exposure of the peritoneum as well as to coldness of the atmosphere, irritation of the peritoneum during the manipulations, impaired renal activity, or nephritis. Death is especially apt to occur in old, weak, or anemic women. In combating shock, heat must be applied and stimulants administered. Salt solution may be given by the bowel or under the breasts.

Nervous Phenomena.—These vary greatly after operations and depend on a variety of conditions, *e. g.*, the patient's temperament, previous health, severity of operation, extent of anesthesia, etc. Very frequently there are restlessness, anxiety, loss of control, excitability, unreasonableness; sometimes, hysteric symptoms. Serious mental disturbances are uncommon. In the course of an extensive operative experience only two of the author's cases have developed genuine maniacal symptoms. They developed within ten days after abdominal section; one case recovered in a few days, the other after eight weeks.

Hemorrhage.—Internal hemorrhage may be due to various causes. The most common cause of severe bleeding is slipping or loosening of a ligature. It may be associated with the straining of vomiting or coughing. In most cases such a calamity occurs on the first or second day, though it may be later.

Hemorrhage also may take place from torn adhesions. In all these cases it is intraperitoneal. Sometimes extraperitoneal bleeding may occur, *e. g.*, in the broad ligament, and this may occasionally burst into the peritoneal cavity. Hemorrhage may also occur in connection with the abdominal wound when the patient has hemophilia, leukocythemia, jaundice, or purpura.

If a drainage-tube has been used, the internal hemorrhage may soon be detected; if not, the symptoms and physical signs indicate the condition. The pulse becomes rapid and thready, the temperature falls, the face gets pale and waxy. Respiration increases, and the patient is thirsty, restless, and pants for air. She may complain of faintness, dizziness, dimness of vision, or see dark spots before her eyes. If the case ends fatally, she becomes collapsed, the pupils dilate, the pulse gets unrecognizable, the temperature falls, and the limbs become cold. On bimanual or abdominal examination a boggy, indefinite fulness may be made out—dull on percussion in the flanks. If the blood is extraperitoneal, its circumscribed and unilateral position may be determined.

In all cases, as soon as hemorrhage is suspected, if no drainage-tube has been used, a stitch or two near the lower end of the wound should be removed and a tube should be passed deeply into the pelvis in order to determine the presence of blood. When this is found intraperitoneally, the abdominal wound should be reopened, the source of hemorrhage found, and the vessels ligated. Oozing from raw areas may be checked by continuous catgut suture or by cauterization. The blood is then washed out of the peritoneal cavity with sterilized normal salt solution, some of it being left in the cavity to be absorbed into the system.

When the hemorrhage is extraperitoneal, ice-bags may be applied to the abdomen and ergot given internally.

In all these conditions the general treatment of hemorrhage may require to be carried out, *e. g.*, warmth, injection of warm normal saline solution into the rectum, subcutaneously, or into a vein.

Ileus.—This term is applied to an obstructed condition of the intestine which prevents the normal passage of its contents.

It may be caused by adhesion of the bowel to a raw area, by incarceration of a loop of gut intraperitoneally in a suture, in bands of adhesions, or by inclusion in the abdominal or vaginal incision, by twisting, by compression of a bloody or inflammatory exudate. It may be due to paralysis of the bowel due to sepsis.

In many cases the paralysis is caused by gaseous distention. The condition may develop within twenty-four hours after operation or not until several days have passed.

The symptoms are obstipation, abdominal distress or pain, vomiting, which may become fecal in character, distention of the belly.

It is often difficult to be certain as to the cause of the ileus. Some of the most alarming cases are those in which there is mere gaseous distention, and improvement is very rapid as soon as the passage of gas and feces has been obtained. When the usual well-known treatment fails to ameliorate the condition and the patient is becoming exhausted, the question of surgical interference must be considered, and must not be too long postponed. Previous to the operation thorough lavage of the stomach should be carried out.

A general anesthetic is rarely necessary, local anesthesia with Schleich's solution being sufficient. The abdomen should be opened and the obstruction relieved. Manipulations will be easier if the distended gut be punctured with a trocar to remove the gas, the opening being afterward carefully closed with a suture. If the obstruction cannot be overcome, a short circuit may be established between the intestine and colon across the obstructed area, or a loop may be brought to the incision so that enterostomy may later be performed. If the ileus is due to septic paralysis, the abdomen is treated according to the methods described on p. 244.

Sepsis.—Most of the deaths in the first week are due to septic infection. All varieties may occur, though in most cases following abdominal or vaginal sections the predominant features are associated with infection of the peritoneum.

Indeed, cases in which the latter condition is not present are rare.

Recently attention has been directed to a form of toxemia termed *acid intoxication*. It occurs in a variety of conditions, and may follow operations.

The patient becomes delirious and then comatose. The breath has a peculiar sweetish, pungent odor, there is a distaste for food, slight rise of temperature, and, in most cases, vomiting when anything is taken into the stomach, the vomitus being sometimes colorless, sometimes bile-stained. Acetone or diacetic acid is found in the urine, the quantity being, however, no index of the severity of the condition. There is diminished alkalinity of the blood.

In administering saline solution by the bowel sodium bicarbonate should be added, as recommended by Brewer. This surgeon recommends the following test for acetone: Heat 20 c.c. of urine in a small glass retort and condense the vapor in a test-tube; then add sufficient potassium hydrate to render the reaction alkaline. Place in it four or five drops of Gram's solution of iodopotassic iodid and heat gently. If acetone is present, a well-marked iodoform odor is evident and yellow crystals form in the tube.

When general septic peritonitis is present, definite symptoms usually develop first on the third day, though they may appear earlier. Tympanites develops, and tenderness on pressure. If the patient feels pain, it is not often severe, and may disappear. Nausea and vomiting are usually present. The pulse becomes rapid, soft, and often irregular. The temperature rises, great variations being found. The patient becomes weak; her face is anxious, and the eyes appear sunken, with dark rings around them. The intellect is generally quite clear. The tongue gets dry and brownish.

Treatment of Sepsis.—In the early stages an enema of warm soap-suds ($\frac{1}{2}$ pint), turpentine ($\frac{1}{2}$ oz.), and castor-oil (1 oz.) or sulphate of magnesia (1 oz.) should be given and at intervals of five or six hours.

A pint of normal salt solution containing sodium acetate (20 gr.) should be administered every six or eight hours by high rectal injection. When the bowel rejects the enemata, normal salt solution should be given subcutaneously.

An attempt should be made to move the bowels by calomel and saline cathartics.

Brandy and champagne are to be given by the mouth or in nutrient enemata. Strophanthus and strychnin are valuable stimulants.

In cases in which sufficient nourishment cannot be given by stomach or rectum, subcutaneous alimentation, recommended by Lennander, of Upsala, and Barker, of London, may be tried. A solution of pure glucose in distilled water, isotonic with the blood, is used. To this is added enough pure sodium chlorid to make a proportion of 0.9 per cent. (this being nearer the normal blood than the ordinary 0.6 per cent.). Enough pure glucose is dissolved to make a 5 per cent. strength. The solution is sterilized by boiling; the amount evaporated may be replaced by boiled distilled water. It should be injected at blood temperature, a hollow needle attached to a tube and funnel being used.

Incision and drainage of the peritoneal cavity may be necessary (see p. 231).

Local Inflammation.—A localized peritonitis in the pelvis may take place, probably due to germ infection, often associated with the irritation of some foreign body, solid or fluid. Adhesions form, and the inflammation does not become general. Sometimes localized cellulitis may occur. Collections of blood may become infected and form pus.

When suppuration takes place in these cases, the pus tends to burrow,

and may escape either into the peritoneal cavity, bowel, bladder, vagina, or through the abdominal wall. Thrombosis may occur in neighboring vessels, and pyemia or embolism may result. The clinical symptoms are pain, rigors, elevated temperature, headache, nausea, or vomiting. After a time a hectic condition develops.

These inflammations in their early stages may be treated by purging, blistering, and the hot douche. When pus forms, it may be removed, and the cavity drained, if possible, *per vaginam*.

Inflammation may also occur around the stitches in the abdominal wall. The chief cause is imperfect technic. The infection usually ends in suppuration—stitch abscess. In such cases the suture affected must be removed, and, if necessary, the openings enlarged so as to allow free outward drainage and irrigation with antiseptic lotions.

Patients in whom suppuration of the abdominal wound occurs should be kept in bed longer than usual in order to diminish the risk of after-stretching and herniation of the cicatrix.

Opening of the Abdominal Wound.—This may occur before the stitches are removed, if they are not of good material, or if there be any great strain on them, *e. g.*, severe coughing. Generally it occurs after they are removed too early, because of imperfect strapping or because of increased intra-abdominal pressure. Infection of the incision is also a cause of weakening of the wall. In such cases the intestines may be forced out among the dressings.

The accident is a serious one and is apt to result in death. When it is discovered, the dressings should be removed and the intestines replaced under the strictest aseptic technic; they should be washed with normal salt solution. The abdominal incision is then closed, a drainage-tube being inserted into the peritoneal cavity through its lower end.

Tetanus.—This complication rarely occurs. According to Olshausen, it is most common in cases in which the clamp has been used, in those in which a pedicle is treated extraperitoneally by means of perforating needles or the wire *serre noeud*; sometimes, in cases where the pedicle is ligated by the intraperitoneal method. The tetanus is by many believed to be caused by faulty ligation of the pedicle, the nerves not being thoroughly compressed, but left in an irritable state. In all probability the tetanus bacillus is introduced by some flaw in technic.

The treatment is that of tetanus in general. It may be necessary to tighten the constricting clamp or to remove it, along with the perforating needles. Sometimes excision of part of the end of the stump may be required.

Perforation of Bowel.—This may be due to an incision made during operation, to a tear made in separating adhesions, to the giving way of a stitch after an operation on the bowel-wall. It may follow intestinal obstruction, the pressure of a drainage-tube, the irritation of a ligature. It may be due to malignant disease, or may follow opening of the abdomen for tuberculosis, due to the rupture of a tubercular ulcer. It may be caused by the extension of a suppurating area.

Treatment.—When the gut is wounded in operations, it should be closed with Lembert sutures. In the case of a diseased wall or a large tear, resection of the affected portion may be carried out, though if the patient's condition be very weak, it may be less risky to sew the opening to the edges of the

abdominal incision. When the opening occurs in the rectum in the pouch of Douglas, if possible it should be closed with sutures on the peritoneal side. If this cannot be done, resection is indicated. If this is not advisable, drainage of the pelvis should be carried out through an opening made in the vagina by means of chinosol gauze. Neither food, purgatives, nor enemata should be given for several days.

It may be advisable to perform a colotomy in order to prevent feces from passing down the rectum. When a fecal fistula forms, it should be dressed carefully; after it has existed for a time its closure should be attempted.

Ventral Hernia.—This may result from careless closure of the incision, *i. e.*, from not bringing toward the middle line all the tissues in the edges of the wound. The use of the drainage-tube or suppuration in the wall tends to lead to a weakening in the wound, which may be followed by hernia.

It may be due to too early work or exercise after convalescence.

When the hernia is first discovered, operative repair should be carried out.

Parotitis.—This complication is rare, and has been especially noticed after ovariectomy. It may occur on one or both sides, and usually develops from five to seven days after operation. It is probably caused by infection introduced through the operative procedure. It leads to local swelling and pain, with fever. Sometimes suppuration takes place in the gland.

Thrombosis.—Femoral or saphenous thrombosis occasionally follows pelvic operations and is probably usually due to sepsis. In some cases other factors may be causal, *e. g.*, traumatism of vessels caused by pressure of instruments, sudden change in pressure due to the removal of large tumors, tight bandaging. When this complication arises, the patient should be kept at rest longer than usual. The affected limb should be elevated and wrapped in cotton. Soothing applications may be necessary. In the late stage gentle massage may be carried out. Later, it may be necessary for the patient to wear an elastic stocking.

Pulmonary Troubles.—Bronchitis occasionally develops after operations, especially if they have been prolonged or the patient's skin has been much exposed, and is much more frequent after ether anesthesia than after any other. Great care should be taken to prepare patients beforehand and to keep them very warm during operations. Ether should not be used if patients have been subject to bronchial affections.

Pleurisy rarely occurs, and is usually associated with septic infection.

Pneumonia sometimes develops, and may or may not be septic in origin. When associated with infection, it is generally fatal.

Pulmonary embolism is rare, and usually fatal. It is due to the detachment of a thrombus formed in one of the femoral veins and may occur both in septic and in nonseptic cases. In the author's first series of 1000 abdominal sections one death was due to this complication. G. B. Miller has stated that most so-called pleurisies following abdominal operations are due to emboli of small size.

VAGINAL SECTION OR COLPOTOMY.

After the abandonment of the Freund operation for the removal of the carcinomatous uterus by the abdominal route (introduced in 1878) vaginal

extirpation gradually grew in favor, and ever since has been widely practised. Previous to that period vaginal incision had practically been limited to cases of pelvic abscess. In 1857 Atlee removed a suppurating ovarian cyst through the posterior fornix. In 1870 Thomas described a method of removing an ovarian tumor *per vaginam*, but this operation was rarely attempted until within recent years. About thirty years ago Battey carried out vaginal oöphorectomy for the induction of the menopause. In 1887 Gussacrow advocated vaginal incision in certain cases of pelvic hematocele. Since that time many other intrapelvic conditions have been treated by operative measures carried out through the vaginal opening, and, at present, a number of enthusiastic operators advocate this route to the exclusion of the abdominal incision in a large percentage of cases.

In favor of colpotomy it is urged that there are less shock, less postoperative disturbance, and less danger to life. An abdominal scar is also avoided. As regards a limited percentage of cases, these claims may undoubtedly be sustained.

If an operation may be performed equally safely and satisfactorily by either route, the vaginal should be selected, but when this route is recommended for routine work in preference to the abdominal incision, too strong a protest cannot be raised.

The ideal which some operators set before them of merely removing some pathologic condition is a very bad one, and is out of harmony with the trend of the best work of recent years. It is equally important that removal shall be accompanied by procedures calculated to diminish the risk of after-troubles. Thus, in removing adherent structures, *e. g.*, pus-tubes, it is necessary that freshly denuded peritoneal surfaces should be covered as much as possible. This protective work cannot be carried out satisfactorily by the vaginal route. The sigmoid flexure is very often adherent to the left diseased appendages and broad ligament. After its separation the adherent area may very often be stitched to the side wall of the pelvis, so that it may not again become attached to viscera; this procedure is possible only by the abdominal route.

In dealing with the appendages of one side it is often found that the opposite tube and ovary are prolapsed and somewhat adherent, so that it is advisable to separate the latter, cauterizing or covering the denuded areas, and stitching the infundibulopelvic ligament to the lateral wall of the pelvis at the level of the brim so as to suspend the prolapsed structures; it is evident that such work is impossible by the vaginal route. In a considerable number of cases of pelvic disease the vermiform appendix is also affected. Very frequently this complication is found during an abdominal operation, when it has not been suspected by the operator; occasionally the appendix is intimately blended with an infected tube or ovary. Whenever the appendix is affected, it is always best to remove it. If, therefore, an operator adopts the vaginal route extensively, it is certain that he will leave a diseased appendix in his patients in a considerable number of instances. Moreover, in removing diseased right appendages, he occasionally runs the risk of tearing the appendix. This accident as well as the tearing or cutting away of a portion of adherent intestine has happened in the practice of more than one enthusiastic colpotomist known to the author.

One great advantage possessed by the operator who performs an abdominal section is that he is able to explore the entire peritoneal cavity and determine the condition of the various tissues and organs. Very frequently valuable information is acquired in reference to important structures, *e. g.*, calculus in the kidney or gall-bladder, malformations, adhesions, etc. By the vaginal incision no such knowledge can be gained. The advantage claimed for colpotomy, *viz.*, that it has no abdominal scar, is too trivial for consideration, though it may appeal to the esthetic proprieties of the female sex.

The statement made as to the diminished mortality of colpotomy operations is entirely misleading. Indeed, it is almost impossible to establish a comparison with the abdominal method which is at all exact. Operations in uncomplicated cases, which may be performed as easily by one route as by the other, should have, in the hands of an expert operator, an equally low mortality. Regarding complicated cases, there can be no doubt as to the greater safety of the abdominal method, all other conditions being similar.

In considering the question of choice between the abdominal and vaginal routes, the size of the vagina must always be an important consideration. In the nulliparous or virgin woman there is very little scope for the performance of operations through the vaginal incision.

Indications.—1. *Myoma Uteri.*—Removal of small myomata may sometimes be carried out. Extirpation of the entire uterus by morcellation may also be performed when the swelling caused by the tumors is not more than five inches, when the vagina is roomy, when the tumor is partly or wholly in the pelvic cavity, and not extensively adherent.

2. *Malignant Disease of the Uterus.*—Extirpation of the uterus by the vaginal route is widely practised. At the present time, however, abdominal hysterectomy is coming somewhat into favor.

3. *Retroversion of the Uterus.*—The operations of vaginal fixation and vaginal shortening of the round ligaments are recommended by various operators (see pp. 486, 491).

4. *Inversion of the Uterus.*—Where operation is necessary in this condition it may usually be carried out by the vaginal route.

5. *Intrapelvic Adhesions.*—Various operators have recommended the vaginal route for the breaking up of the pelvic adhesions. In the author's experience this is an unsatisfactory procedure. Denuded areas are formed which are certain to give rise to more adhesions. This condition can be satisfactorily dealt with only through an abdominal opening, which allows measures to be undertaken for the covering of raw surfaces.

6. *Diseased Ovaries.*—In some cases these structures may be removed through a vaginal opening; resection also may be carried out.

Ovarian cysts may sometimes be removed, but the cases should be selected with great care. Favorable ones are those which are small, movable, thin-walled, and nonadherent. Unfavorable ones are those which are very large, malignant, adherent, containing many cysts, those which are intraligamentous, or in which torsion of the pedicle has occurred.

7. *Tubal Disease.*—Certain tubal enlargements may be removed by colpotomy, but in cases in which adhesions are numerous and complicated, the procedure may be very unsatisfactory and risky.



Fig. 122.—Anterior colpotomy incision of Dührssen and others.



Fig. 123.—Anterior colpotomy incision of Orthmann and others.

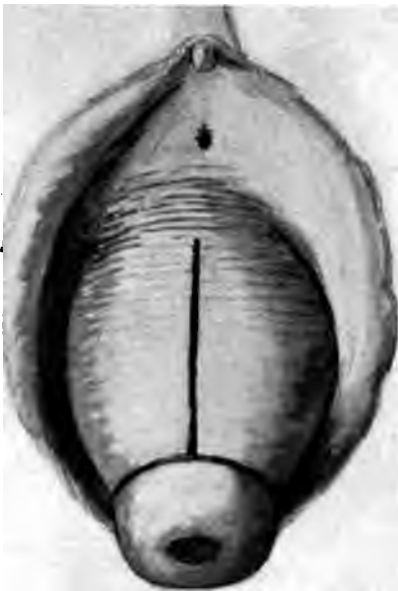


Fig. 124.—The author's colpotomy incision.



Fig. 125.—Colpotomy incision (anterior) of Mackenrodt and others.

8. *Pelvic Abscess.*—Incision followed by drainage is very frequently indicated, whether the products of infection are tubal, ovarian, peritonitic, or cellulitic. The opening is usually made posterior to the uterus.

9. *Ectopic Gestation.*—In some cases the pregnant tube in the early weeks may be removed by vaginal section, though most operators choose the abdominal route because there is much less risk of rupturing the tube and causing hemorrhage.

After rupture of the tube and the formation of a localized pelvic hematocoele vaginal incision followed by gauze drainage may be very satisfactory. Sometimes, however, on account of recurrent hemorrhage, it is necessary to open the abdomen afterward in order to control bleeding.



Fig. 126.—Anterior colpotomy. The vaginal wall is dissected from the cervix and the uterovesical pouch of peritoneum opened.



Fig. 127.—Colpotomy. This illustration represents the vaginal wall dissected upward from the cervix, and a transverse incision made in the pouch of Douglas.

10. *Extensive Infection of the Genitalia.*—In cases of infection involving the uterus and adnexa, in which total extirpation is indicated, the vaginal route is greatly favored by several operators. The author prefers the abdominal incision in the great majority of cases because through it complicating adhesions may be more satisfactorily removed and denuded areas covered.

11. *In cases complicated by some distant lesion, e. g., heart, lung, kidney disease, etc.,* it is recommended that the vaginal route be employed in order to lessen the shock to the patient. In such conditions, by careful preparation of the patient, by rapidity in operating, by using local anesthesia and diminishing the general anesthesia, the author has obtained as good results by the abdominal as by the vaginal route.

12. *Exploration*.—Incision of the vagina for digital exploration of the pelvis may sometimes be carried out, though its scope of usefulness must be regarded as very limited.

The Operation.—The patient is prepared in the manner described on p. 217. Various forms of incision are employed, the patient in all cases being in the lithotomy position, and the vagina being opened as much as possible by means of retractors.

In cases in which great difficulties or complications arise after the vaginal operation has been commenced, it may be necessary to complete the procedure through an abdominal incision.

1. *Posterior Colpotomy*.—The cervix is drawn downward and forward as much as possible, and a transverse or T-shaped incision, an inch or more in length, is made through the posterior fornix, so as to open the lowest portion of the pouch of Douglas. This method is much less employed than anterior colpotomy. It is chiefly used in exploring the pouch of Douglas, in breaking up posterior adhesions, and in opening fluid collections in the pelvis; very rarely for other purposes.

Anterior colpotomy is much more frequently employed for operations on the uterus and appendages. Various forms of incision have been employed.

1. *Transverse*.—Dührssen and others have recommended a transverse incision in the anterior fornix below the junction of the bladder and cervix, an inch or more in length. The cervix being pulled downward and backward, the bladder is stripped from the cervix and anterior vaginal wall and pushed upward. The uterovesical pouch of peritoneum is then opened.

2. *Mesial*.—Orthmann and others make a mesial incision through the anterior vaginal wall extending from the junction of the latter with the cervix an inch and a half or more.

3. *T-shaped Incision*.—Mackenrodt makes a transverse incision like Dührssen's and another mesial one at right angles for an inch and a half or more through the anterior vaginal wall.

4. *Author's Method*.—A circular incision is made around the cervix just below the attachment of the vaginal wall. This is joined by a mesial incision, an inch and a half or more in length, in the anterior vaginal wall. The cervix being well pulled down, the wall of the vaginal vault is stripped



Fig. 128.—Colpotomy combined with anterior colporrhaphy. An oval flap of the anterior vaginal wall is removed at the beginning of the operation.



Fig. 129.—Colpotomy combined with anterior colporrhaphy. After the removal of the anterior vaginal wall flap the rest of the wall is stripped from the cervix and the uterovesical pouch of peritoneum opened.



Fig. 130.—Colpotomy, combined anterior colporrhaphy, and amputation of the cervix. The cervix is represented as split prior to amputation.



Fig. 131.—Colpotomy combined with amputation of the cervix. The stump of the cervix is represented surrounded by the vaginal flap.



Fig. 132.—Colpotomy combined with anterior colporrhaphy and amputation of cervix. The appearance of cervix and vagina is represented as they appear at the completion of the operation.

upward until the uterovesical peritoneal pouch is reached. The anterior vaginal wall is also stripped somewhat from the base of the bladder. The uterovesical pouch is then opened.

The advantages of this method over the others are that the uterus can be pulled down to a greater extent and that more room is obtained for intrapelvic manipulations. Sometimes the latter may be facilitated if an additional transverse incision be made through the pouch of Douglas. Frequently when the uterus is considerably enlarged from chronic metritis it is advisable to ligate one or both uterine arteries (easily exposed in the raw surface already made).

When the enlarged uterus cannot be well brought down, its descent may be assisted if the base of one or both broad ligaments be divided internal to the ligatures. At the end of the operative procedures the uterus is pushed into place, the peritoneum closed, and the original vaginal incisions closed with catgut.

When amputation of the cervix is called for in addition to the colpotomy, this procedure is carried out after the closure of the peritoneum, and the vaginal flaps are then brought over the stump of the cervix and stretched to the margin of the cervical canal. When, however, the size of the uterus is a hindrance to its descent, amputation should be carried out after the vaginal wall is stripped up. Less of the vagina is then occupied by the organ when the body is pulled down and greater access to the pelvis may be obtained. The stump of the cervix in such a case is covered by the vaginal flap at the end of the operation. When anterior colporrhaphy is required, the necessary flap is removed when the first incision is made. The closure of the raw surface thus produced is brought about by means of continuous catgut suture at the end of the entire operative procedure. Chinisol gauze is placed in the vagina.

After-treatment.—The patient is kept at rest in bed, measures being adopted somewhat similar to those described in connection with abdominal section. The gauze is removed from the vagina on the third or fourth day, and a fresh piece may be inserted or vaginal antiseptic douches may be given once daily for two or three weeks. The patient may be allowed to sit up between the twelfth and sixteenth day, as a rule.

ANESTHESIA.

General anesthesia is of great value in diagnosing many intrapelvic and intra-abdominal conditions, especially in girls, nervous women, and in those with tense or thick abdominal walls. Ether and chloroform are the drugs most frequently employed for this purpose. During recent years the author has to a great extent discarded these, using nitrous oxid gas in preference (except in cases in which it is contraindicated). The great advantages of this anesthetic are its quickness of action and the absence of after-sickness. The gas is administered through an apparatus which allows air to be inhaled at the same time.

In carrying out operative procedures the author uses nitrous oxid and ether (except where there is some contraindication) in the majority of cases. He has found the Packard inhaler very suitable for the administration.

A mixture of nitrous oxid gas and air is first given, and as unconsciousness is developed, ether vapor is gradually forced into the inhaler by means of a rubber bulb attached to the bottle of ether. The nitrous oxid reservoir is then disconnected, and a mixture of air and ether continued. When chloroform is indicated, the same inhaler is employed, air being allowed to enter freely. When the mask of the inhaler does not fit a patient's face closely, anesthesia may not readily be induced, because an excessive amount of air is inhaled: under these circumstances it is advisable to administer ether by the drop method, a thick Esmarch mask being used; chloroform may be given by means of the Packard inhaler or an Esmarch mask, the drug being carefully dropped on it from a small bottle. When the latter apparatus is used, the patient's face should be smeared with vaselin. Every operator should carefully supervise the administration of these anesthetics, allowing as little as possible to be used. Unless this be done, patients will often be subjected to unnecessarily prolonged or reckless anesthesia. In cases in which surgical procedures are to be carried out in the lithotomy posture previous to abdominal section, it is frequently possible to carry out the former either without a general anesthetic or by local anesthesia.

The author has in recent years considerably extended the sphere of employment of local anesthesia, even in major operative procedures, in cases in which prolonged general anesthesia is not considered advisable, *e. g.*, old age, renal, pulmonary, and cardiac diseases, marked anemia, chronic wasting disease, and sepsis. He recommends the Schleich infiltration method, solution No. 2 being employed. The composition of this solution is as follows:

Cocain muriat,.....	0.100
Morphin muriat,.....	0.025
Sod. chlorid,.....	0.200
Aq. destil.,.....	100.000

In making the solution the author is accustomed to prepare it twenty minutes before it is used, adding a little formalin to it to lessen the risk of infection.

It is generally stated that the largest dose of cocain which may safely be injected is $\frac{1}{4}$ gr. or 4 dr. of the above solution. The author has frequently used 6 dr. without producing any toxic symptoms.

Solutions of β -eucain are preferred by some operators, as having less toxic effects than cocain. Barker highly recommends the following:

β -eucain,.....	3 gr. (0.2 gm.)
Sodium chlorid,.....	12 gr. (0.8 gm.)
Solution of adrenalin chlorid (1 : 1000),	10 min. (0.6 c.c.)
Distilled water,.....	3 $\frac{1}{2}$ oz. (100 c.c.)

All this quantity or even twice as much may be used at one time. The adrenalin greatly increases the duration of analgesia. After the injection is made it is advisable to wait for thirty minutes before operating.

The solution is made as follows: The water is boiled several minutes. The β -eucain and pure sodium chlorid are then added, and boiling continued for two minutes. This is allowed to cool, and the drops of sterile adrenalin solution are added. (If the latter be boiled, its effects are not so lasting.) An alkali spoils it. Hence the needle must be boiled in pure water, the points being kept in alcohol.

Various plastic operations on the cervix, vagina, and vulva may be carried out. Vaginal extirpation of the uterus may also be performed. In carrying out the latter operation, after infiltrating the fornix vaginae and opening the peritoneal pouches, no further application of the anesthetic is required, as a rule; occasionally, however, when the patient complains, it is advisable to infiltrate the broad ligaments before ligating them, since the latter procedure usually causes distress.

In opening the abdomen the skin may be infiltrated for a distance of four or five inches in the line of the incision to be made. Thereafter, in the majority of cases, the author rarely injects any more of the anesthetic solution.

Formerly it was his practice to infiltrate the successive layers divided, but he now prefers to make a rapid division of the abdominal wall.

Various operations may be carried out after the abdomen is opened, *e. g.*, removal of diseased tubes and ovaries, shortening of the round ligaments, myomectomy, supravaginal amputation of the uterus, etc. It is important that the patient should be encouraged and cheered by the operator throughout the operation. If a few drops of chloroform be sprinkled from time to time on a mask held over the patient's face, a strong suggestive influence is often exercised, the patient believing that she is being deeply anesthetized. Sometimes a patient may become so nervous and excited that her struggles make it impossible to continue the operation until general anesthesia is induced. But even if such a course is pursued, the advantage has been obtained of reducing to a minimum the amount of chloroform or ether which is necessary.

The longest operation performed by the author without general anesthesia was an abdominal hysterectomy for the removal of a cystic fibromyoma of the uterus weighing eighty-seven pounds. It was performed in the Presbyterian Hospital, Chicago, December 16, 1902. The abdomen was opened after Schleich infiltration of the skin. After working for an hour the patient became somewhat restless, and she was allowed to inhale a few drops of chloroform. During the remaining hour and a half this procedure was repeated from time to time, six drams of the drug being used in this way. The patient was conscious throughout the whole operation, and frequently engaged in conversation; no reflexes were abolished.

With regard to the sensibility of the various tissues exposed and handled, the following observations have been made. On dividing the infiltrated portion of the skin no pain is felt if the infiltration has been well carried out. Division of the other tissues of the abdominal wall always causes pain, the parietal peritoneum being usually most sensitive. Suturing or dragging of a portion of the layer is always painful.

The separation of adhesions between any structure and the parietes causes pain except when the adhesions are very slight, whereas the separation of adhesions between viscera or between new-growths and viscera very rarely causes distress. The omentum may be ligated, divided, or cauterized without pain; when it is pulled downward, pain is caused. When the intestines are handled, either inflamed or normal, no pain is usually produced unless the mesentery is dragged somewhat forcibly. Removal of the vermiform appendix does not generally cause distress. When its mesentery is stretched or when adhesions between it and the parietes are separated, the patient usually complains.

Compression of the broad ligaments with forceps or ligature usually causes the patient to complain, as does perforation or division of them. Cauterization, scraping, or stretching of the peritoneal surface of the uterus is rarely noticed by the patient, but she usually complains when the organ is pulled forcibly upward or laterally, putting the ligaments on the stretch. The separation of tubes and ovaries adherent to the wall of the pelvis always causes pain, though manipulation of these structures when free is apparently painless. When the ovary is firmly squeezed, resected, or sutured, some complaint is usually made. Separation of the bladder from the uterus causes little or no distress. Division of the vaginal wall around the cervix in the performance of a hysterectomy always causes some pain. Sponging of the visceral peritoneum with gauze usually causes no distress, whereas the same procedure applied to the parietes causes pain which varies in intensity according to the force applied. The pain felt on the removal of a gauze drain from the abdomen is probably either due to friction against the parietal peritoneum or to traction on a mesentery.

Slow flushing of the peritoneal cavity with hot (105°-108° F.) normal saline solution usually causes no distress. If, however, the abdomen be unduly distended, the patient may complain.

My observations are almost entirely in harmony with those recently published by Lennander, of Upsala, who has made a very important contribution to our knowledge of the sensibility of the entire abdominal cavity, his chief conclusion being that all pains felt within the abdomen during operations or in disease are to be referred to parts which are innervated by the intercostal, lumbar, and sacral nerves, *i. e.*, to the diaphragm and abdominal walls, as well as to such organs of which we know with certainty that they are innervated by the nerves in question or are in near relation to them.

Spinal Anesthesia.—This method has not been used to a great extent in gynecologic operations, mainly on account of a general wide-spread prejudice which exists against it. Moreover, Tuffier, one of the chief advocates of the procedure, states that it is not very suitable for intraperitoneal operations on account of the vomiting, which is apt to take place, inconveniencing the operator. Pitres and Abadie state also that the sensibility of the peritoneum is only diminished, not abolished. It is stated by those who have substituted eucaïn for cocain that there is very much less sickness. Another advantage of eucaïn is that it can be better sterilized. The injection is made with a platinum needle four inches long with an iridium point. The skin of the lower dorsal and lumbar regions is made as aseptic as possible, the patient sitting on a table with the back arched forward in order to separate the laminae of the vertebrae as much as possible. The spine of the fourth lumbar vertebra is then found. If this be not well-defined or if the patient be fat, the bony point may be located by noting where a horizontal plane at the level of the highest parts of the iliac crests crosses the spine. A point is then selected 1 cm. external to and below the spinous process, and a small incision, 1 cm. in length, is made through the skin. The needle is introduced into this wound when bleeding ceases, and is directed vertically downward and inward so as to enter the space between the laminae of the fourth and fifth lumbar vertebrae. As it penetrates the subarachnoid space clear cerebro-

spinal fluid escapes through the needle. The syringe containing the solution of cocain or eucain, both thoroughly sterilized, is then attached to the needle and 1 c.c. of a 2 per cent. solution slowly injected. The needle is then removed, and the skin-incision covered with a collodion dressing. If the needle strikes bone, its direction should be altered. Sometimes when it is in the subarachnoid space no fluid may escape because the point may be covered by membranes. It should then be withdrawn or rotated slightly. If blood escapes from the needle, it should be withdrawn somewhat and introduced in another direction. Analgesia is generally complete within five to ten minutes, rarely longer. Its duration varies, the average being about an hour. The area of analgesia also varies. Usually it is well marked as high as the level of the navel, the skin being affected as high as the sternum; sometimes a higher level is reached. In the great majority of cases a feeling of general malaise, oppression in the epigastrium, sweating of the face, a sensation of heat, respiratory anxiety, and, sometimes, thirst are noted about six minutes after the injection, lasting ten to fifteen minutes. In one-third of the cases nausea and vomiting occur ten to fifteen minutes after the injection of cocain. This is more common in women than in men.

After-effects.—Sometimes slight sickness continues. Headache, which may be very intense, occurs six to eight hours after the injection in 90 per cent. of cases. Occasionally it may last one or more days. In a considerable number of cases a rise in temperature may occur.

Dangers.—The chief danger is that the patient may be poisoned by cocain. The use of eucain reduces such a risk to a minimum. Sepsis due to imperfect technic must be considered. Injury of nerve structures in the canal may be caused, though the risk appears to be infinitesimal. Evacuation of too much cerebrospinal fluid may cause serious nervous disturbance. In reference to spinal anesthesia it is interesting to note that Bier, one of the pioneers in its employment, advises against its wide adoption, chiefly owing to risk of poisoning with cocain.

Anesthesia by means of Scopolamin and Morphin.—Recently the use of this mixture, introduced by Schneiderlein in 1900, has been recommended both for surgical operations and in labors. Ziffer has had a large experience, and advises that a hypodermatic injection containing 0.0005 gm. ($\frac{1}{300}$ gr.) of scopolamin and 0.01 gm. ($\frac{1}{10}$ gr.) morphin be given at intervals of two and a quarter, one and a quarter, and one quarter of an hour before operation. If this be not sufficient, chloroform may be used, the quantity required being very small. The risk of syncope is diminished, there is little excitement and rarely vomiting, and the patients do not complain of pain on waking. Ziffer states that there is no absolute contraindication, but advises if great frequency of pulse and lessened respirations are found after two doses have been given, no more should be injected. The solution should be made fresh each time it is used.

CHAPTER VIII.

AFFECTIONS OF PERITONEUM AND CELLULAR TISSUE.

ACUTE GENERAL PERITONITIS.

Etiology.—Inflammation of the peritoneum, like inflammation of every other part of the body, is not to be regarded as a specific process working *per se* toward a calamitous end. It has a beneficent purpose, being nature's method of defending her tissues when injured, of repairing inroads made by the enemy, and of destroying and removing the latter. In the great majority of instances the inflammatory process is directed chiefly against the action of infecting micro-organisms or their deleterious products, though other influences must also be considered.

Various micro-organisms have been found associated with peritonitis, of which the most frequent are the *Bacillus coli communis*, streptococcus, and *Staphylococcus pyogenes aureus*, the most frequent being the first named. Thus Fränkel, in 31 cases of peritonitis, found *Bacillus coli communis* in 9, streptococcus in 7, *Staphylococcus aureus* in 1, pneumococcus in 1, and *Bacterium lactis aërogenes* in 2. In 4 cases he could not find any micro-organisms.

Tavel and Lanz found *Bacillus coli communis* alone in 15 cases, in association in 16 cases; streptococcus alone in 3 cases, in association in 15; staphylococcus alone in 2 cases, in association in 6; pneumococcus alone in no case, in association in 2.

Hawkins found in 61 cases of general peritonitis or appendicular abscess due to appendix disease that the *Bacillus coli communis* was present in 57, in 50 cases being the only germ present. This authority states that in most cases of peritonitis due to intestinal perforation the *Bacillus coli communis* is found usually alone.

The predominance of the *Bacillus coli communis* not in association with other micro-organisms is of interest, and the explanation in a number of cases may be understood by Barbacci's experiments on animals. He found that when perforating peritonitis was produced artificially, this organism alone survived, even though for a time in the early stages of the inflammation other germs might have developed. (In these cases the colon bacillus was found in different parts of the body, *e. g.*, liver, spleen, kidneys, glands, etc.)

In cases of hernia different observers have found *Bacillus coli communis* in the sac in a large percentage of cases; also in the peritoneal exudate following internal strangulation. In the latter condition, produced artificially in dogs, Bönneken found this organism in most cases; occasionally other germs were found. Then in peritonitis associated with ulceration or suppuration of the gall-bladder the *Bacillus coli communis* is found in many cases.

Staphylococci are rarely found alone in peritonitis—generally with more virulent organisms. In puerperal peritonitis the most frequent organism

is the streptococcus. In peritonitis following abdominal section streptococcus, *Staphylococcus aureus* and *albus* are most commonly found, but in some cases the *Bacillus coli communis* is present.

Experiments show that organisms are most infective when introduced with a fluid difficult of absorption or when the endothelium is damaged. The *Bacillus coli communis* becomes virulent when there is some disturbance in the bowel-wall due to such causes as diarrhea, constipation, strangulation, etc.

It has been pointed out by Treves and others that freshly filtered fluid from the bowel placed in the peritoneal cavity causes peritonitis which is usually fatal; in such a case the *Bacillus coli communis* is the infective agent. If the fluid be filtered through plenty of gauze, the effects are less severe. If the fluid be sterilized, no evil results follow its introduction. Neither does sterilized fecal matter cause peritonitis.

Klecki has pointed out that the ileum contains the most virulent forms of the colon bacillus, the jejunum the next, and the colon the least virulent. He has also shown that when artificial compression of a knuckle of bowel is carried out in the dog, leading to fatal peritonitis, the virulence of the colon bacillus taken from the constricted portion is much greater than that of specimens taken from uninjured parts of the bowel. He believes that the state of the epithelium covering the intestine is a most important factor in determining the passage through the wall of micro-organisms.

It is of great importance to bear in mind the variation in virulence of micro-organisms, both in varying conditions in the body, as well as under artificial conditions. *Bacillus coli communis*, for instance, is found to vary in artificial media, losing its virulence more quickly in agar than in broth. Ekehorn showed that when taken from mild forms of appendicitis it was less virulent than when taken from acute and severe attacks.

In this connection may be noted the observation of Tavel and Lanz, who found this organism in the peritoneal cavity in some cases of localized appendicular abscess without the presence of any peritonitis; and that of Welsh, who found the organism in the peritoneal cavity in some cases of nonperforating ulcers of the intestine.

Tavel and Lanz have published experiments dealing with the changes produced by variations in dosages. They have shown, for example, how a very slight dose of a given microbe might produce little or no disturbance, while a larger dose produced a chronic peritonitis, more or less localized, a still larger dose causing a diffuse inflammation and a fatal end, while a very large dose produced death before any local changes were developed.

The peritoneum is capable of disposing of considerable quantities of micro-organisms. Various experiments may be referred to in this connection:

1. *Grawitz's*.—(a) Nonpyogenic microbes introduced into the peritoneal cavity in large or small quantities cause no harm.

(b) Large quantities of microbes which ordinarily are harmless may be able to start a severe peritonitis if the absorptive power of the peritoneum be impaired.

(c) In several cases streptococci and staphylococci injected in a watery solution caused no changes.

(d) The introduction of the same quantity with a fluid difficult of absorption led to purulent peritonitis; the same occurred where the peritoneum was injured.

Pawlowsky carried out Grawitz's experiments and obtained similar results.

2. *Waterhouse's*.—(a) Six c.c. of a cloudy culture of *Staphylococcus aureus* was introduced into the peritoneum of a dog, and death of the animal did not occur.

(b) The same quantity, along with 8 c.c. of urine or blood, did not cause its death.

(c) The same quantity with 15 to 20 c.c. of urine or blood led to severe peritonitis.

(d) Three cm. of the culture with 3 cm. of blood-clot caused death in twenty-four hours.

(e) Two c.c. of staphylococci or 1 c.c. of streptococci from an acute abscess led to death in twenty-four hours.

When similar quantities of these cultures were introduced with plenty of water, the animal usually survived; when introduced with turpentine there was no peritonitis, but in cases where the peritoneum was first irritated with turpentine and the microbes then injected, fatal peritonitis occurred. This authority also found that the presence of ascitic fluid in the peritoneum of the cat favored death after the introduction of the cultures.

Halsted found by experiment that ligation of the omentum followed by the introduction of infective cultures caused peritonitis in every case.

Regarding immunity in the peritoneum, Treves, Melsome, and others think that a certain degree may be produced in animals, both local and general, against septic infection. Treves points out that operations in chronic peritonitis or after repeated subacute attacks are less risky than in cases where there has been no previous trouble.

The pneumococcus is a very rare cause of peritonitis. It may sometimes extend through the diaphragm in cases of pneumonia. It is difficult to produce an infection by introducing cultures into the peritoneum of animals.

The gonococcus does not often cause general peritonitis, unassociated with other organisms, but that it may do so is now well established. This was first demonstrated in 1895 by Frank, of Louisville. Hunner and Harris have reported 7 cases and have collected 32 others. This micro-organism is usually introduced through the Fallopian tubes, its effects on the pelvic peritoneum being localized. When it is found in diffuse peritonitis, pyogenic cocci are usually associated with it. The relationship of trauma to peritonitis is not thoroughly understood. It is certain that local inflammatory changes tend to follow irritation of the endothelium, *e. g.*, by exposing it during operation to dry or cold air; by rubbing it forcibly; when certain pathologic fluids escape into the peritoneal cavity, *e. g.*, contents of a dermoid cyst.

Sterilized croton oil and other irritants will set up peritonitis. In many cases, however, it is possible that the peritoneal reaction is mainly due to the influence of micro-organisms or their products which have reached the injured visceral peritoneum from the lumen of the bowel. The effects of the bile escaping into the peritoneum vary according to whether or not it contains micro-organisms. When it causes peritonitis, the colon bacillus is usually the infecting agent. A piece of sterilized gauze shut up in the peritoneal cavity gradually becomes encapsuled in inflammatory adhesions, and this may occur with few or no symptoms.

In all conditions which impair bodily vitality the resisting power of the peritoneum is diminished, so that it may be more readily infected.

The following points in regard to the peritoneum in general are worthy of notice: Its whole surface is probably as great as the skin-area of the body. It has marked powers of absorption, taking up milk, blood, peptones, etc., rapidly. It is said to be able to absorb an amount equal to 3 to 8 per cent. of the body-weight. There is some doubt as to the presence of stomata between the endothelial cells: Clark states that appearances which have been described as stomata are really the retraction of the cells at their junctions. Absorption of fluids from the peritoneal cavity probably takes place both by blood-vessels and lymphatics. Fluids do not gravitate to the pelvis from different parts of the peritoneal cavity with the readiness which might be expected. This is in some way related to the influence of intra-abdominal pressure; though, of course in some instances adhesions cause the retardation. The frequency with which intestinal contents fail to escape after rupture or perforation of the gut has been noted, and is believed to be due to the effect of intra-abdominal pressure.

Considerable attention has been directed to the following interesting experiments of Muscatello. Fine carmin granules in suspension were injected into the peritoneal cavity of dogs. When the dog was suspended head down: In five to seven minutes granules were found in the retrosternal lymph-glands, even before they were visible in the lymphatics of the diaphragm. There was no trace in the pelvic and abdominal lymph-glands; at the end of six hours the diaphragm was injected; in one and one-half hours they were found in the glands of the spleen and liver.

When the dog was suspended with the head up: After five and one-half hours no carmin was visible to the eye in any gland. Microscopically, however, it was found in the retrosternal and in the other intrathoracic glands, but not at all in the spleen, liver, pancreas, lumbar, or aortic glands. Muscatello thinks, therefore, that the normal course taken by particles of solid matter in the peritoneal cavity is first through the diaphragm to the thoracic glands, thence into the blood-stream, whence they find their way to the glands in various parts of the body.

The current to the diaphragm exists in spite of gravity, though the latter retards it. He thinks that the diaphragm is the only part of the peritoneum capable of absorbing solids from it, the lymph-glands in the mediastinum being the collecting center. Most granules are carried off by leukocytes which pass into the peritoneal cavity, but it appears that very small particles may pass through the peritoneum without such assistance.

The peritoneum is normally very sensitive, but the sensitiveness is lost as it becomes altered in inflammatory processes. The following experiments of Reynier and Reichel may here be noted:

1. They poured boiling water or perchlorid of iron into the peritoneal cavity of the rabbit, producing marked shock and death within twenty-four hours.

2. The above experiment, when preceded by a nerve sedative, *e. g.*, chloral, always resulted in the animal living twenty-four hours or more.

The peritoneum varies in its liability to infection according to its position. It has been fairly well established that the small intestine and omentum

are most easily infected and that the infection tends to spread rapidly. The parietal peritoneum, while much more sensitive to pain, is less easily infected than the intestinal peritoneum. The liver peritoneum is also less liable to severe infection than the latter.

It is not common to find localized or encysted peritonitis in the area of the small intestine apart from tuberculosis, as Treves points out. The localized forms are found almost entirely in the subphrenic region, between the diaphragm and transverse colon, in the region of the cecum, especially in its outer side, and in the pelvis.

Pathology.—The changes produced vary greatly as regards their nature and extent.

There are at first increased congestion and redness. These may be uniformly or irregularly distributed, being often most marked where the coils of bowel touch. The surface of the peritoneum usually gets dull, swollen, and softened. The minute changes are: subserous edema; transudation of serum and leukocytes from vessels; proliferation of connective-tissue corpuscles; changes in the endothelial cells and proliferation of some of them; formation of vascular granulations.

Small petechiæ may be present. Fibrinous exudation takes place, with very little serum in many cases; organization takes place, and lymph is deposited on the peritoneum, at first soft, afterward firm. This thickens in regular or irregular masses, and tends to mat together adjacent structures. As the inflammation advances it tends to form thickenings and adhesions. This variety is known as *adhesive peritonitis*.

In other cases there is only a slight degree of fibrinous exudation, the marked feature being pouring out of serum. This may almost be pure, like ascitic fluid, or may be mixed with some fibrinous exudation, forming a serofibrinous mass. The more abundant the latter constituent, the more tendency to coagulation does it show. Lymph-flakes may be seen floating about, and they may get deposited on the peritoneum. The fluid may remain free or may become encysted. As it gets absorbed, adhesions and thickenings tend to remain. This variety is known as *serous peritonitis*.

In the most extreme cases of acute peritonitis there is pus-formation. The pus may be mixed with serum, or may be thick and white. It may be discolored, foul-smelling, or mixed with blood in various proportions. The pus generally works its way to the pelvis, but often it remains in other parts, where adhesions may help to determine its position. This form is known as *purulent peritonitis*. Sometimes the peritoneal fluid is of a colloid or gelatinous consistence.

Sometimes foul-smelling gas may be found in the peritoneal cavity; when perforation of viscera has occurred, various materials may be found in it.

The intestines are distended with gas, their walls being edematous, softened, and infiltrated. The stomach is often small and contracted. In extensive and severe peritonitis the abdominal muscles may be softened and somewhat degenerated.

Peritonitis may be more or less general or localized. The three seats in which localized attacks mostly occur are the region of the diaphragm, that of the cecum (especially its outer side), and the pelvis. It is rare to find the area of the small intestine the seat of these circumscribed attacks. In these

three regions the type of inflammation is usually healthy, and recovery is most frequent from them, either spontaneously or after operation. These local attacks of peritonitis may cause thickenings and adhesions, collections of serum or pus. Thus abscesses may be formed in the pelvis, iliac fossæ, lesser omental sac, hypochondrium, subphrenic region, etc.

A general peritonitis may succeed the circumscribed form, but not often. Adhesions prevent the spread, or it may remain localized because of some special local peculiarity. Some think that the omentum helps to prevent the spread of inflammation from below upward, and Mickulicz believes that the transverse colon prevents its extension from above downward.

Symptoms.—The symptoms of acute peritonitis vary according to the cause, its seat and extent, the condition of the patient, etc.

Local.—Pain is one of the most marked symptoms. It usually begins in one region, and then spreads rapidly, though it may sometimes be at first referred to the region of the solar plexus. It may vary at different spots, being described as hot, cutting, boring, darting, burning, etc. Exacerbations occur from time to time, owing to movements of the bowel. It is aggravated on exertion. The sufferer usually lies on the back with the thighs well flexed. Abdominal breathing is lessened. The abdomen is very sensitive to touch, and becomes rigid. Where perforation of the gut has occurred, the belly-wall tends to sink in toward the spine.

As the inflammation extends the pain, hyperesthesia, and contraction of the abdominal wall pass away, and the tenseness of the latter is merely due to the distention of the intestines. This change is especially marked when sepsis develops. If septic phenomena occur very early in the case, there may be no hyperesthesia or pain whatever.

Disturbances occur in the alimentary tract. There are loss of appetite, thirst, nausea, vomiting. The latter varies in degree in different cases, and sometimes may be absent.

The tongue is furred, often being red and irritable, gradually becoming dry. There is often a disagreeable taste in the mouth, while the breath is offensive. Eructation of gas is common. Constipation is a common feature, mainly owing to paralysis of the bowel, though sometimes diarrhea is met. Irregular contractions of the intestine take place, in the early stages particularly, causing gurgling sounds. Jaundice is sometimes present. Micturition may at first be frequent, but later there may be retention. The urine is diminished in quantity; sometimes there is suppression.

Hiccup is often present. The respirations usually get frequent and shallow. Marked dyspnea may exist, and the heart's action may be very rapid. The changes in the respiration and circulation are due to the general condition, to the pain from the peritonitis, to action of the inflammation on the diaphragm, and to the pressure of the distended intestines. In some cases they may be aggravated by the development of pleurisy, pneumonia, or pericarditis.

General Symptoms.—Rigors may mark the invasion stage of the attack, but they are often absent. The febrile phenomena are very variable, and they are no sure guide to the extent or gravity of the affection. Treves points out that in some cases the temperature moves steadily upward; in others, steadily downward; in others, a fairly even line of high fever may be followed;

while in others, a normal or subnormal course may be marked. The occurrence of diarrhea or of a sudden perforation is usually marked by a drop in temperature. Sometimes the temperature may fall only gradually, especially where the bowels continue to keep open. When the bowels cease to act, it tends to rise again after the fall. When the perforation occurs slowly, it may rise at first and then sink. Persistent subnormal temperature makes the prognosis very bad. It is often found where general sepsis is present. The most marked febrile signs occur with a plastic peritonitis, or where there is a localized pus-collection.

Where the peritonitis is due to hernia, the temperature, as a rule, remains low. Before death in marked septic cases the temperature usually sinks, though sometimes it may rise very high.

When gangrene of the bowel is present, the temperature is usually high. When there is disease in the appendix, it is generally high.

The *pulse* increases in rapidity, usually varying from 120 to 160. It is at first full and bounding, becoming small, hard, wiry, or thready; sometimes, very soft and irregular.

The *face* has an anxious or pained expression, and the features appear sunken and pinched, dark arcolæ being around the eyes. There may be a feeling of great prostration and restlessness. There may be more or less cyanosis. Often sleeplessness or headache is complained of; sometimes delirium or stupor. The mind usually remains bright and clear to the end. As death approaches the extremities get cold, and the skin covered with a clammy sweat.

In pure gonorrheal peritonitis Hunner and Harris state that the characteristic course is one in which the onset is acute and stormy, the symptoms abating after one to three days, recovery being usually rapid. In the cases reported by them there was a mortality of 31 per cent.

Physical Signs.—The abdomen early becomes rigid, and it may be slightly depressed; in perforation cases, markedly so. Abdominal respiration is slight. The surface is tender to the touch. Later, meteorism develops as the abdominal walls relax. The distention of the abdomen is symmetric generally, but not always. Sometimes a transverse groove may be made out in the epigastrium. In very muscular persons there may be little enlargement. Intestinal movements are sometimes visible.

On percussion the note is tympanitic and varies in different parts. If the distention is extreme, the sound is muffled and toneless. The splenic and hepatic dulness is lessened. Small quantities of fluid cannot be made out. Where there is a considerable collection, dulness may be got on percussion in the dependent parts, varying on change in posture. Where there is encysted fluid, the dulness is unaffected by change of position. Fluctuation may be obtained if there be a sufficient quantity of fluid in the peritoneum. On auscultation, friction-sounds may sometimes be heard; also, movements of intestinal contents.

On examination of the chest the heart is found displaced upward and to the left, *i. e.*, when the abdomen is distended, and there is often dulness at the base of the lungs.

Course and Terminations.—The patient may die, or recovery may gradually take place where the inflammation has not been too severe or extensive.

Sometimes a chronic condition may develop, the temperature remaining high and irregular. Fluid collections may remain, and a condition of pyemia may develop, or the collection may burst. A condition of wasting may supervene, and death may follow. Extensive adhesions may develop, giving rise to much after-trouble.

In most fatal cases of peritonitis the chief symptoms are those due to systemic poisoning, death being due to toxic infection rather than to the changes in the peritoneum. Indeed, toxic phenomena develop more rapidly in peritoneal infection than in any other variety. It is noteworthy that in these cases there is no constant relationship between the severity of an attack and the local changes in the peritoneum. In some of the worst cases very slight peritoneal changes may occur before death supervenes. This is due to the fact that the virulence of the poison has affected the whole system before the defensive peritoneal reaction has had time to manifest itself to any extent. Then, again, some of the most favorable cases are those in which extensive alterations have occurred in the peritoneum in its wide-spread efforts to destroy and eliminate the toxic material.

Differential Diagnosis.—Various conditions may be mistaken for acute peritonitis.

1. There are certain abdominal neuroses which may lead to an error in diagnosis. These may give rise to such symptoms as pain, a rigidity of the walls, sensitiveness to touch, meteorism, vomiting, constipation, diarrhea.

2. Myalgia, hyperesthesia, or localized inflammations in the abdominal wall.

3. Colic, the passage of renal and biliary calculi.

4. Extreme tympanites and pain in low febrile conditions, *e. g.*, typhoid.

5. Marked enteritis.

6. Extraperitoneal rupture of a tubal pregnancy or of an aneurysm; hematocele.

7. Acute pleurisy or pneumonia may at first simulate peritonitis.

Prognosis.—The worst forms are those due to perforation and severe septic infection. Very serious are those associated with nephritis. In infancy peritonitis is usually fatal. A poor condition of health is most unfavorable. The more localized the affection, the greater is the chance of a favorable issue. Well-marked tympanites, continued vomiting, the passage of blood from stomach or bowel, continuous hiccup, high temperature, early collapse, rapid, feeble, and irregular pulse, a comatose condition, are indications which make the prognosis very grave. Complications of the nature of pleurisy, pneumonia, or pericarditis greatly increase the risks.

Treatment.—Complete rest with the knees flexed over a support is necessary. The chest and arms should be covered with a woollen garment.

As little food as possible should be given by the mouth. Indeed, it is always advisable to wash out the stomach early and to feed the patient for several days with alternating normal saline and nutrient enemata. If brandy or whisky is indicated, it may be added to the saline solution.

The patient should be fed by small enemata of peptonized beef-tea, meat-extract, or somatose. Irritability of the rectum may be somewhat relieved by occasional flushings with water or weak cocain solutions. When the sphincter relaxes, the enemata must be stopped, but when this occurs,

the patient is generally beyond hope. When there is diarrhea, feeding must be tried by the mouth, and very often in such cases it may be carried out.

For the severe thirst, iced milk and soda-water may be employed, but often hot water or hot tea may be preferred. Plasmon is usually more easily assimilated than milk. The continued sucking of ice is to be avoided. Sometimes a large drink, even if it be followed by vomiting, relieves thirst for some time. The mouth may be rinsed out from time to time with glycerin and water, or with eau de Cologne and water.

Saline aperients may be given at the onset of peritoneal inflammation, but they must not be used when general peritonitis is established, especially when a septic condition is recognized, and, of course, they are not to be administered by the mouth when any intestinal obstruction exists, or when perforation of any part of the alimentary canal is suspected. Enemata may be given in the hope of clearing the lower bowel.

Whenever there is collapse, alcoholic drinks, especially champagne and brandy, must be given by the mouth or by enemata. The continued use of brandy or whisky is advisable in all cases in which there is marked sepsis.

Opium should be used as little as possible. In the early stages it is frequently necessary, and may be given as an injection of morphin. It may often, at this stage, avert the ill-effects of shock. The indication should be pain, and not mere discomfort and distress. In advanced septic cases it is not necessary.

Strychnin administered hypodermatically is a valuable cardiac stimulant. Strophanthus and digitalis may also be employed.

Calomel, or enemata containing turpentine, sometimes relieve meteorism; but the passage of a long rubber tube by the rectum is generally more efficacious.

Nausea and vomiting may often be relieved by champagne, creasote, or by hydrocyanic acid and bismuth. For hiccup, sedatives may be given, mustard may be applied to the epigastrium, or in bad cases chloroform administered.

Local applications to the abdomen often give great relief. In the early stages, either cold or hot compresses may be employed with turpentine or anodynes. In localized affections a coil through which ice-water circulates may be used on the abdomen.

Operative Measures.—In cases of general peritonitis the adoption of every method recommended by surgeons of repute has been followed by unsatisfactory results; in spite of the advocacy of each, favored probably by some happy experience of exceptionally successful operative procedures, it must be confessed that infective peritonitis is attended in the hands of the most skilful operators with a very high mortality.

The great variations which follow the development of micro-organisms in the peritoneal cavity, both as regards the effects on the system and the reactionary changes induced in the tissues exposed to the infection, have already been pointed out.

The accumulated facts which have been summarized lead clearly to the realization of the difference which exists between an infective process started within the peritoneal cavity and one developing in most other parts of the body, *e. g.*, arm, buttock, etc. The peritoneal cavity is in intimate relation-

ship with an enormous storehouse of micro-organisms, viz., the alimentary tract, from which the germs may pass with great readiness where any condition exists which diminishes the vitality of the bowel-wall. Moreover, owing to the great area of peritoneum, toxic matter may be absorbed by the system in very large quantities.

According to the indications furnished by our present knowledge, general infection of the peritoneum must be treated as early as possible by surgical measures.

The abdomen should be opened, and any recognizable source of infection, *e. g.*, suppurating tube, gangrenous appendix, perforated bowel, etc., removed. The cavity must then be irrigated with normal saline solution (106° F.) for fifteen or twenty minutes. In this way a large quantity of pus and foreign matter may be removed, but complete cleansing is impossible, as has been demonstrated by Reichel's experiments on dogs. Gauze pads may also be used to remove some of the foreign matter.

Several years ago it was customary to use antiseptic irrigation in such cases, solutions of boric acid, salicylic acid, and salts of mercury being employed, but gradually most operators abandoned this procedure because of the fear of injuring the peritoneum or causing dangerous complications from the absorption of the antiseptics.

In 1898 I carried out a large number of experiments on dogs and rabbits to test the effect of solutions of chinosol and formalin on the peritoneum and general system under normal conditions, and in various stages of infective peritonitis.* I found that free irrigation of the peritoneal cavity of these animals with solutions of chinosol (1:1000) and formalin (25 drops to a pint) caused no ill effects whatever, even though the abdomen was filled as full as possible before closure. In artificially produced septic peritonitis their use appeared to have very beneficial results. Since that time I have very frequently employed them in the treatment of septic peritonitis in the human female.

After irrigating the peritoneum with normal saline solution as above described, I have made it a practice to continue irrigation for five or ten minutes with normal saline solution containing one or other of the above-mentioned antiseptics, in the strength stated or half this strength, some of the fluid being left in the cavity when the abdominal wall is closed.

Closure is not completely carried out. An opening should be made in the pouch of Douglas, so as to establish an opening into the vagina (cleansed previous to operation). Chinosol gauze is packed in the pelvis and passed into the vagina.

The abdominal incision is closed, with the exception of one portion through which a large rubber or glass tube is passed.

When the patient is placed in bed, the upper part of the body should be considerably higher than the lower in order that drainage toward the latter may be established. In twenty-four hours she should be placed flat again and the saline antiseptic solution should be introduced freely through the abdominal tube for several minutes. After another day or two this tube may be removed and the opening allowed to close gradually, while fresh chinosol gauze is introduced into the pelvis *per vaginam*. In another day or two this may also be removed.

* "Montreal Medical Journal," 1898.

Such treatment may be expected to be satisfactory only in early cases, before general toxemia is marked, or before there is extensive plastic peritonitis. When the latter condition exists, it is not advisable to separate the intestines to any marked degree, as considerable oozing of blood may result.

CHRONIC PERITONITIS.

This is met localized or diffuse, and occurs in many varying conditions. It may follow an acute attack. In the majority of cases it is due to the action of infecting organisms. It may be associated with the irritation of cirrhosis or carcinoma of the liver, cancer or ulceration of stomach or intestine, old hernias, ascites, tapping of fluid in abdomen. It may spread from localized inflammations, *e. g.*, perihepatitis. It is said to follow cold or exposure. It may occur in chronic nephritis, gout, rheumatism, alcoholism, lead-poisoning, etc. It may be due to tubercular or cancerous infection of the peritoneum.

Morbid Anatomy.—Great variations are found. There may be thickenings of the peritoneum, adhesions, matting together of viscera; serous, seropurulent, or purulent effusions, usually more or less circumscribed; caseation or calcareous degeneration of inflammatory products may be found, and pigment deposit; distortion, displacement, or obstruction of viscera may be brought about; the intestinal wall may be wasted, though the stomach is oftener thickened.

Symptoms.—These are very varied. If the condition has developed from an acute attack, there is a gradual alteration in the type of the symptoms noticed.

If no acute attack precedes it, the onset is usually very insidious. There may be uneasiness; dull or irregular pains, sometimes somewhat aggravated; constipation, diarrhea, colic, flatus, vomiting, dyspepsia; there may be increased discomfort or pain on movement or on palpation of the abdomen. Owing to the pressure of inflammatory thickenings on various parts, various phenomena may supervene, *e. g.*, jaundice, ascites, thrombosis, edema of the legs, albuminuria, etc.

The temperature shows great variations. It may not be elevated at all or it may be very irregular. There may be gradual weakening and wasting, hectic, increased pulse, dryness of skin. The health of the patient may vary greatly from time to time.

Physical Signs.—The abdomen may be enlarged, partly owing to the fluid in the peritoneal cavity, or partly to gas in the bowels. The enlargement may be uniform, but it is often irregular. On palpation there may be tenseness or a uniform doughy feeling; or irregularities may be felt, *e. g.*, nodulations. On percussion, free fluid may be recognized, but usually it is found to be localized; generally, irregular areas of dulness and resonance are distinguishable.

Fluctuation may often be got in fluid collections, and friction-fremitus may occasionally be made out. Change of position, as a rule, causes little alteration in the physical signs.

Treatment.—Rest in bed for a long period is often advisable. Good surroundings, change of air, careful dieting, cod-liver oil, wine, iron, quinin,

and other tonics are of great value. The iodid of iron or potassium may be given by mouth. Counterirritants to the abdomen are good, *e. g.*, iodin, blisters; the inunction of mercury ointment is valuable. Pressure by means of cotton-wool and a bandage should be employed. Collections of serous fluid may be tapped. Purulent gatherings may be treated in the ordinary surgical manner.

ACUTE PELVIC PERITONITIS (PELVEOPERITONITIS; PERIMETRITIS).

This is a local peritonitis within the cavity of the pelvis. Much that has been described in connection with general peritonitis may be applied here, but it is necessary to make special reference to the localized affection. All varieties are met in the pelvis, *e. g.*, simple, adhesive, serous, purulent.

Etiology.—The great majority of inflammations in the pelvic peritoneum are due to infection by micro-organisms or their products. The poison may enter by way of the genital tract, by the bowel, or by the bladder. The first of these is the most frequent path, and it is easy to understand why this should be so. The Fallopian tubes communicate directly with the peritoneum; the uterus is continually being subjected to injury in connection with childbirth, and is consequently exposed to infection from the exterior. In tabulating the chief sources of pelvic inflammation we may particularly note the following:

1. Imperfect precautions to insure asepsis in performing operations on the genital tract, bladder, and rectum.
2. Abortion and childbirth. Here the infection may spread along the Fallopian tube or through the tissues, either directly by the lymphatics or by the blood-vessels.
3. Gonorrhea and latent gonorrhea in the male are generally regarded as important sources of infection. At present it is, perhaps, safer to say that pelvic peritonitis is very often associated with these conditions than that it is due to direct action of the gonococcus. Very probably the infection is often due to pyogenic cocci which have formed a nidus in the discharges due to the inflammation set up in the lower genital tract (*vide p.* 135).
4. Extension from inflammatory areas, *e. g.*, tubes, uterus, ovaries, cellular tissue.
5. It is often associated with new-growths, *e. g.*, ovarian tumors, fibroids, carcinoma, tubercle; and with swellings, *e. g.*, hemocele.
6. Severe chills, especially during menstruation, are believed to occasionally cause pelvic peritonitis.
7. Sexual excess is described by some. This must be regarded as very doubtful.
8. Traumatism, *e. g.*, the forcing of fluids along the Fallopian tubes by careless irrigation of the uterus.

Symptoms.—The pulse is first rapid, full, bounding; later, small, hard, wiry, or thready, or, in severe cases, soft and irregular. The temperature rises early, and continues more or less elevated. Often the onset is marked by rigors. Pains of a burning, cutting, darting, or boring nature develop. There are nausea, vomiting, constipation, sometimes diarrhea. It is rare to find such symptoms as have been described in connection with severe

general peritonitis unless the local condition spreads and becomes diffuse. When pus-collections have formed, the symptoms are those of abscess. Pus may tend to open through vagina, bowel, bladder, or through the abdominal wall.

Physical Signs.—The abdomen is early rigid. Afterward it may be distended. Both legs are drawn up. The belly is tender or painful in its lower part. On bimanual examination the vagina is hot and sensitive. When there is free fluid in the pelvis, an indistinct boggy fulness may be made out. When consolidation has taken place in it, a hard mass like plaster-of-Paris is left behind and at the sides of the cervix; sometimes around it. In other cases masses of serous fluid may be encysted by adhesions among viscera, and are felt in the middle line pushing the uterus forward; sometimes in front of the uterus, when this organ has been retroverted; sometimes on either side behind the broad ligament.

These accumulations may form large swellings which may simulate cystic tumors. The false capsule may become quite thick, and large vessels may develop in it. The fluid is highly albuminous, differing from that contained in ovarian or in parovarian cysts.

After an acute attack has passed off various conditions are found, *e. g.*, thickenings, adhesions, displacement of uterus or appendages. There is usually considerable tenderness on examination.

Treatment.—*General.*—The patient should be placed at rest in bed. Milk and potash or soda-water, peptonized beef-tea, and beef-jelly are to be given by the mouth. If these are rejected by the stomach, the latter should be washed out and saline and nutrient enemata should be administered by the bowel. Alcoholic stimulants are to be given if the patient is weak; if pus be present, large quantities may be required. Pain is to be counteracted with hypodermatics of morphin. Quinin is of use as an antipyretic. Early, castor-oil or saline aperients are of great value.

When convalescent, the patient should be given plenty of nourishing and easily digested food; the bowels should be kept regular. Iron, wine, and other tonics are to be given. The patient should carefully avoid exertion and exposure to cold or damp.

Local.—A coil through which ice-cold water circulates may be placed over the lower abdominal region in the early stages. Many authorities prefer to use hot fomentations, hot vaginal douches being also given frequently. When a patient is kept at rest under such treatment, nonpurulent exudates may be gradually absorbed, adhesions being left behind.

Operative Measures.—In localized peritonitis surgical interference is indicated when a collection of pus forms. An incision should be made into the latter and drainage carried out, care being taken to avoid contamination. When the pelvis is the seat of trouble, an attempt should always be made to establish drainage through the vagina and not through the abdominal wall. For the first twenty-four or forty-eight hours a gauze tampon may be used. Thereafter, daily irrigation with an antiseptic lotion is advisable. At a later period it is frequently necessary to perform a second operation (usually through the abdomen) in order to remove infected tissue, *e. g.*, a pyosalpinx or ovarian abscess.

Martin, of Greifswald, has recently employed the hot-air treatment

of Bier in the treatment of pelvic inflammatory conditions. The patient is placed in a box so that only the abdomen and pelvis are exposed to hot air produced by gas or a spirit-lamp. The exposure lasts for half an hour, by which time the temperature reaches 130° to 150° C. A tubular speculum in the vagina allows the air to reach the fornix. On the first occasion the patient cannot usually bear a temperature greater than 100° to 110° C. It should be raised on successive days. At the end of the application the temperature should be gradually reduced. High fever, menstruation, and heart disease are regarded as contraindications. The following benefits are claimed:

Diminution of pain, germicidal action, promotion of absorption, softening and loosening of adhesions, stimulation of general nutrition, and improvement in local conditions. It also hastens suppuration, where this process threatens, more rapidly than if no heat be applied.

Kehrer recommends hot air especially for pelvic exudates, the temperature of the skin being 212° F. The heat is furnished by electric lamps inclosed in asbestos.

The value of heat in diminishing pain and promoting absorption is well established. Little permanent benefit can be expected where cicatrization has occurred or where firm adhesions have formed between tissues.

In the convalescent stage, the patient should wear a flannel binder for months.

CHRONIC PELVIC PERITONITIS.

I have already described the chief changes found, in describing chronic peritonitis in general. In the pelvis, thickenings, adhesions, and displacements of the uterus and appendages are produced. Encysted serous accumulations may be found which simulate cystic tumors. Doran, however, points out that these may sometimes be discovered, without any previous inflammatory history. The swellings are usually fixed, though sometimes partially movable. The ureters may sometimes be constricted. The bladder may be interfered with by adhesions or by effusions. The bowel functions may be affected.

Etiology.—The causes are much the same as those described in connection with acute pelvic inflammations, whether the condition follows the latter or is a chronic process throughout. Some emphasis should be placed on the influence of chronic constipation. There can be little doubt that this condition may be associated with such change in the vitality of the wall of the rectum as to allow microbes or their products to extend to the pelvic peritoneum, cellular tissue, and viscera. Ulceration of the bowel may have the same effect. In this relation certain experiments of Capaldi are interesting. He closed the anus of guinea-pigs, causing fecal retention. After a time colon bacilli were found in the peritoneum and genital organs.

Symptoms.—These vary greatly. Where an acute attack has preceded the chronic trouble there is a history of a gradual change from the acute symptoms. In other cases the affection begins insidiously and without marked symptoms. Sometimes there may be a history of pain, perhaps beginning in connection with a menstrual period. In some cases there is a history of a slight attack of pain with fever.

Various degrees of pain may be met—dull, sharp, aching. It is often worse after exertion, at menstruation, during coitus, or at defecation. There may be menorrhagia, metrorrhagia, or irregular menstruation. Sterility is common. The health of the patient is below par, and she often has various reflex nervous disturbances. In many cases she develops marked neuroses. It is important, therefore, to note that the suffering of which the patient complains may be often very largely neurotic, noncommensurate with the amount of pathologic change in the pelvis.

The bladder functions are not often disturbed, but there may be irritability, tenesmus, dysuria, or incontinence. These symptoms may be due to the pressure of effusions or of a displaced uterus, to the traction of peritonitic bands, or to inflammation in the bladder-wall. The circulation and innervation of the gut may be affected and its peristalsis interfered with. Rectal catarrh, constipation, diarrhea, flatulence are met. Rarely, ileus results from interference by adhesions.

Treatment. The general means taken should consist of measures to improve the general health and to strengthen the nervous system. The stomach and bowels should be kept in good order. The patient should rest for a time from hard work. Coitus should be avoided. If the patient is very neurotic, a course of Weir-Mitchell treatment is valuable.

Locally, the hot douche, hot hip-baths, vaginal tampons soaked in glycerin or in ichthyol and glycerin, and blistering above Poupart's ligament may be employed.

Pelvic massage has been highly praised in the treatment of the latter condition. It is undoubtedly possible in this way to stretch many adhesions as well as cicatrized parametric tissue, so that more mobility is possible in the pelvic organs, but in many cases no permanent benefit is obtained. Moreover, there are objections to the routine performance of pelvic massage because of the morbid sexual disturbances that may be caused (see p. 197).

Galvanic electricity has been employed, especially in promoting absorption of exudates, but without such positive beneficial results as to warrant its routine adoption.

Pincus recommends what he terms the weight-posture treatment. It consists in moderate elevation of the pelvis and lower limbs by raising the lower end of the bed 20 to 35 cm., pressure being made on the pelvic structures. Bags of shot weighing four to eight pounds are placed on the abdomen. In the vagina an iodoform gauze bag is fitted and filled with shot not weighing more than two pounds; a rubber bag containing mercury may also be used. When the latter is removed, the bag is distended with air, which may be retained for a time when the patient walks about.

This treatment is employed when the acute stage has passed, when there is no pain, no temperature, no suppuration. That the method is not without risks is evident from the report of Pincus that in 10 per cent. of his cases acute symptoms were produced. It is not likely that the method will meet with much favor.

Schultze's plan of breaking down adhesions forcibly under anesthesia is to be strongly condemned. The method is uncertain and dangerous. Within recent years surgical interference in cases of adhesions has been widely adopted, with very beneficial results in the majority of cases. Occa-

sionally, the bands may be divided satisfactorily through a vaginal incision, but in most instances the abdominal incision should be selected, because the best exposure may be obtained, associated pathologic changes in the viscera may be best corrected, and the covering of denuded areas may be most satisfactorily carried out.

Encysted serous swellings which do not disappear under ordinary treatment may be tapped through the vagina if they can be safely reached. In some cases abdominal section is necessary, the fluid being removed and the adhesions destroyed as far as possible. A. Doran recommends abdominal drainage in some of the cases.

TUBERCULOUS PERITONITIS.

This affection is met under three different sets of conditions, and it is probably always secondary. It may appear as part of a general miliary tuberculosis. It may be a localized development in connection with ulceration of the intestine, beginning in thickenings on the peritoneal surface over the ulcer.

It may be a wide-spread affection in the peritoneum, of a chronic or subacute nature, often associated with ulceration of the bowel, sometimes with enlargements in the mesenteric glands. Tuberculous affection of the Fallopian tubes and uterus may be present. Pulmonary trouble very often exists.

Pathologic Changes.—These present varied appearances. When acute miliary tuberculosis exists, the peritoneum is studded with tubercles in various stages of development, usually believed to be most numerous in the flanks and on the diaphragm, less marked on the intestines. As the process gets more chronic adjacent granulation masses tend to blend. There is abundant citron-colored ascitic fluid produced, sometimes blood-stained, rarely seropurulent. Adhesions are usually slight. In other cases ascitic fluid may be encysted in one or more loculi by means of adhesions.

In another class of cases there is considerable fibroid change, the tuberculous process tending toward improvement. Sometimes this is found as large scattered tubercles, there being no adhesions nor ascites. More commonly there are marked adhesions between the bowels, the omentum being often in a crumpled, irregular mass below the stomach. The mesentery may also be contracted and thickened.

When the tuberculous products break down, different appearances are caused. Sometimes the matted intestines are covered with a mass of gray or yellow adhesive material with caseous masses; on breaking through it loculi may be seen containing clear fluid, caseous matter, chocolate-like fluid, or pus. The bowel may be perforated at points by the breaking down of ulcers. Adjacent coils of gut may communicate, or a fistula may discharge at the umbilicus.

Sometimes there may be extensive suppuration, diffused or localized. Occasionally the mesenteric glands are enlarged, but not often in bad cases of peritonitis. They may form a large irregular mass, several large masses, or a series of small isolated swellings.

Intestinal obstruction may result from the adhesions of tuberculous peritonitis.

Symptoms and Physical Signs.—These vary greatly. Sometimes the trouble begins with rigors; sometimes there is fever. Usually, there are dyspepsia, diarrhea, constipation, and pains in the abdomen. The onset, in the majority of instances, is gradual. The abdomen tends to enlarge, and the patient loses flesh. As the case advances there is an irregular febrile condition, and hectic may develop. There is generally malaise. Often sweating is profuse. There are usually relapses and remissions. There may be general tympanites, or it may be combined with dulness due to free ascitic fluid; or areas of resonance may alternate with patches of dulness, the latter being due to fluid collections or to thickened masses of bowel, omentum, or adhesions. The umbilicus is often protruded. On palpation, the abdomen is often tender over the whole surface or in areas. Enlargements due to affection of the mesenteric glands may be felt.

Differential Diagnosis.—Tuberculous peritonitis may be mistaken for a variety of conditions, *e. g.*, cyst of mesentery or liver; enlargements of kidney; malignant disease in abdominal viscera; appendicular abscess; inguinal hernia; tumors of the abdominal wall; enlarged mesenteric glands have been diagnosed as floating kidney, enlarged spleen, or as various kinds of tumors.

Treatment.—The general treatment for tubercular disease is to be carried out. Prolonged rest under good hygienic conditions is often very beneficial. Locally, the application of a counterirritant, *e. g.*, tincture of iodine or mercury liniment, is valuable, and also the inunction of ointments of mercury.

Operative measures are to be employed in certain cases. When there is free serous fluid or a large encysted quantity in the abdomen, the latter should be opened and the fluid removed. The incision should then be closed. Such a procedure is very often followed by cure.

When the fluid is purulent as the result of a mixed infection, the peritoneal cavity may be irrigated with warm saline solution, and drained for twenty-four or forty-eight hours. If drainage be kept up too long in these cases, a sinus is apt to form, or a fecal fistula, as a result of pressure of the drain on the bowel.

When adhesions and thickenings are prominent, there being little or no fluid, the results of opening the peritoneum are not so satisfactory, though undoubted benefit may result in some cases. In operating, care must be taken not to open the gut. If, owing to adhesions, it be impossible to cut into the peritoneum by one incision, others should be made in the hope of gaining entrance where no adhesions exist. The latter are usually most marked below the umbilicus.

In all cases the tubes should be carefully examined, for they are undoubtedly frequently the starting-point of tuberculous peritonitis. When they are abnormal, they should be removed. Some authorities also advise extirpation of the uterus. This procedure should not, however, be carried out if there are adhesions of the bowel, which are difficult to separate without great risk of perforating the bowel. Sometimes a patient is too weak to bear the strain of extended operative work. In such a case the abdomen should be closed after removal of fluid and after a few weeks may be reopened, in order that the diseased genital organs may be extirpated.

The appendix is also occasionally involved and may be the focus from which the peritoneum is infected. It should, therefore, be removed.

Operative procedures should not be carried out when there is acute general miliary tuberculosis or very advanced tubercular disease in other organs of the body.

The following suggestions have been made to explain the method of cure in these operative cases, namely, that it is due to the admission of light or of air; to the removal of the fluid; to the escape of the ptomaines and toxins produced by the microbes; to modifications of intra-abdominal pressure, leading to an improved circulation and to a more active absorption; to the rest in bed, good feeding, etc.

MALIGNANT PERITONITIS.

This is not very common, and is generally cancerous. In the great mass of cases it is secondary to malignant disease in the alimentary canal, especially the stomach, liver, pancreas, retroperitoneal glands, female genitals. It may be developed by extension or by secondary deposit. It may spread from one serous surface to another, with the formation of adhesions. The chief pelvic causes are malignant disease of the ovaries and rupture of papillomatous cysts.

Peritoneal cancer is most often scirrhus in type, sometimes encephaloid or colloid. The disease is found in diffused nodules or masses, which tend to become umbilicated. The omentum may be drawn up in a mass. There is generally some chronic peritonitis, with more or less effusion, often blood-stained. It may spread to various structures and may interfere with the intestinal tract, narrowing it, or causing ileus. In the colloid form the viscera may be covered with thick, gelatinous masses.

Symptoms and Physical Signs.—Great variations are found. They are due to the general decay in health, the interference with various functions, and to associated peritonitis.

In the early stages there are only obscure and indefinite symptoms. Abdominal pains develop, and various disturbances of the alimentary tract. There is ascites and often jaundice. Cachexia develops, and sometimes marked anemia from loss of blood in the peritoneal cavity. Sometimes there is considerable fever, but generally there is little or no pyrexia, and of an irregular type. There are tenderness and resistance on palpation. Fluid may easily be made out on percussion. Irregular masses may be felt, and enlargements of groups of glands.

Treatment.—The strength must be kept up and the various symptoms treated. It may be necessary to tap the abdomen from time to time.

NEW-GROWTHS IN THE PERITONEUM.

Tuberculosis and malignant disease have already been described. Hydatids sometimes produce large swellings. Lipomata, myxomata, and myxolipomata sometimes develop, to a great extent retroperitoneally. Cysts of various kinds are found, *e.g.*, dermoid, serous, colloid; some of these are probably due to the breaking down of lipomata and myxomata. Fibromata are rare. Malignant adenomata sometimes develop from remains of the Wolffian body.

Treatment.—Cysts may sometimes be evacuated. Solid tumors may sometimes be removed if small or somewhat pedunculated. Shepherd has recently reported a successful case of removal of a very large myxofibroma from the mesentery, eight feet of small intestine being taken away as well.

PELVIC CELLULITIS (PARAMETRITIS).

Nature.—This is an inflammation, acute or chronic, affecting a portion of the pelvic cellular tissue. It is much less frequent than pelvic peritonitis. The most common seats are the bases of the broad ligaments and the uterosacral folds. There is usually some associated peritonitis over the seat of the cellulitis, just as in peritonitis there is more or less underlying cellulitis.

Etiology.—The chief cause—probably the only direct cause—is germ infection, the streptococcus being the most frequent organism. It is doubtful if simple injury will be followed by cellulitis. Traumatism, however, plays an important part in the causation of pelvic cellulitis, namely, by affording an area which allows the germs an entrance ground.

The special conditions with which it is associated are the following:

1. Abortion, premature and full-time labors, infection entering through the raw or bruised surfaces, produced as a result of imperfect asepsis.
2. Operative measures on the genital tract, bladder, or rectum, in which thorough asepsis is not obtained.
3. Diseased conditions in bladder or rectum, whereby infection of the cellular tissue occurs.
4. Secondary to peritonitis.
5. It is said that it may result from a severe chill during menstruation.

Pathology.—At first there is an exudation. This may become quickly absorbed, or only a portion may be absorbed, the rest remaining as a thickening. This may gradually disappear, followed by shrinkage and cicatrization, or pus may form and an abscess be produced, though this is true only of a minority of cases. The pus may burrow in various directions, and may open in the following ways:

1. Through the bladder, rectum, vagina, or urethra.
2. Through the perineum.
3. Through the abdominal wall.
4. Through the obturator, sacrosciatic, or saphenous openings.
5. Through the lumbar region near the kidney.
6. Rarely into the peritoneal cavity.

Exudations spread by lymphatics and directly through the tissues. According to König, there are lines of cleavage so arranged that fluid in the upper portion of the broad ligament extends out to the pelvic wall, then along the psoas iliacus, sinking below the brim. Fluid in the lower and anterior portion passes out to the side pelvic wall laterally, and runs along the round ligament to the abdominal wall, thence by Poupart's ligament to the iliac fossa. When in the lower and posterior part, it burrows around the pouch of Douglas and then follows the course first mentioned above.

When the pus has discharged and healing has taken place, there is more or less contraction and cicatrization in the cellular tissue.

Cellulitis usually leaves more or less marked traces behind it, the most

marked of which are displacements. The most common alterations are found in the uterus. This organ may be lateriverted, when the inflammation has taken place in a broad ligament. When it has existed in the uterosacral ligaments, the lower portion of the organ is fixed and drawn somewhat upward and backward, the fundus bending forward, this condition being known as *pathologic antelexion*.

The ovaries and tubes may be more or less displaced. The bladder may sometimes be altered, and occasionally the rectum may be affected.

Symptoms.—(a) *In Acute Cases.*—There is often a rigor at the onset. There is pain in the pelvis, and, it may be, in the lower abdominal region. Pulse and temperature are elevated. When there is marked exudation, the patient may lie with one leg drawn up. There may be constipation, painful defecation, and dysuria. In slight cases the patient may complain only of slight uneasiness.

(b) *In Chronic Cases.*—The symptoms are much the same as in chronic pelvic peritonitis (*vide* p. 271).

Physical Signs.—In the early stages nothing definite may be made out. A little fulness or tenderness may sometimes be recognized. As consolidation occurs in the effusion, a hard mass may be felt. When in the broad ligament, if it be of any size, it fixes the uterus, and pushes it somewhat toward the opposite side and bulges down the lateral fornix. If the uterosacral folds are affected, the cervix is felt fixed, and there is a thickened mass on each side behind, most easily felt through the rectum. In other cases the thickening may be felt at the side of the bladder, vagina, or rectum, reaching above Poupart's ligament, in the iliac fossa, etc. There is tenderness on pressure. Sometimes on flexing and abducting the thigh, pain runs down the leg owing to the implication of the lumbar and iliac glands and of the tissue around the psoas-iliacus muscle; there may thus be a simulation of hip-joint disease.

It is very rare to find any deposit between the cervix and bladder. When fluid is present, it may often be recognized as a cystic mass, but sometimes it may be thought to be solid. Sometimes pus may exist in the center of thick solid masses, and may be very difficult to make out; it may often be felt as a boggy swelling.

In old-standing cases various cicatrices and displacements are found, the uterus being drawn toward the affected side.

Treatment.—When pus collections form, they should be opened. The chief sites of these have already been mentioned.

Whenever, in such cases, it is possible to open into these cavities without injuring the ureter, large vessels, viscera, or the peritoneal cavity, the pus should be removed, the opening being made through the skin or vaginal surface.

Sometimes it is sufficient to aspirate the collection when it is small. A large collection should be opened freely.

Whenever there are important structures which might be injured by a knife, a director should be pushed into the abscess after an opening is made through the skin or vaginal mucosa. The opening is then enlarged with dressing forceps. In other cases the abscess may be freely opened with a knife. If a finger can be introduced, any septa or masses preventing free escape of the pus may be broken down.

Drainage should be continued by means of antiseptic gauze, or by a rubber tube, after the cavity has been washed out with an antiseptic lotion. The latter should be irrigated once or twice each day. When the opening is made high up in the vagina, it is a good plan to stitch the tube to the edges of the opening for a time.

When it is impossible to open a collection of pus seated close to the rectum by means of the vaginal incision, it should be opened by way of the gut without hesitation, the rectum being carefully cleaned out beforehand. A large opening should be made, vessels being avoided. It should be washed out three or four times daily, and should be made to close from the bottom. The opening should be kept large by the finger, in order that it may be the last to close. If the sphincters of the anus be paralyzed for a few days by forcible stretching, the cavity drains best.

When a pus collection has discharged into the vagina and healing takes place slowly, the opening should be enlarged, and drainage kept up.

If an abscess has opened into the rectum, the opening should be enlarged and all pockets destroyed.

After opening has taken place into the bladder, an effort should be made to open into the abscess cavity between the bladder and cervix, and to establish drainage.

If this be not possible, it may be necessary to make a vesicovaginal fistula, and to dilate the opening by which the pus has entered the bladder.

Some large collections of pus in the cellular tissue cannot be opened without the performance of an abdominal section. The peritoneal cavity is opened and the pus is aspirated. The walls of the sac are then stitched to the edges of the abdominal wound. The opening into the sac is next enlarged, the cavity washed out with an antiseptic, and then stuffed with antiseptic gauze. In two or three days it is removed, and a smaller quantity introduced.

Sometimes on opening the peritoneum it is found that, owing to the fixation of the pus-collection, its deep-seatedness in the pelvis, or its adhesion to intestines, it is impossible to attach its covering to the edges of the abdominal wound. In such a case a careful examination *per vaginam* should be made, in order to determine the possibility of draining the pus by a vaginal puncture. If this can be done a T-shaped drainage-tube should be introduced into the abscess cavity by way of the vagina. The abdominal wound is then closed.

When an opening by way of the vagina cannot be made, the abscess may be opened, carefully cleaned, and drained through the abdominal wound, by Mikulicz's gauze tampon (*vide* p. 236).

PARAMETRITIS CHRONICA ATROPHICANS (I. CIRCUMSCRIPTA; II. DIFFUSA).

Freund has given this name to a slow, chronic process affecting mainly the fascial and aponeurotic structures, producing changes similar to those found in cirrhotic processes in the liver, kidney, etc.

The Circumscribed Variety.—The dense bands may be found in relation to bladder, uterus, or rectum. The disease is believed to start in infection from these different structures. As shrinkage occurs, more or less displacement of one or other of them is produced.

The Diffuse Variety.—This is a rare condition in which a cirrhotic process

affects the whole pelvic cellular tissue. As it progresses vessels are compressed, and there are congestion and catarrh of urethra, bladder, uterus, and rectum. The genitals gradually atrophy; menstruation is at first abundant, and afterward scanty. The cause is not well known. It has been attributed to a weakened condition, produced by excessive child-bearing or suckling.

Symptoms.—These have been described in connection with chronic inflammatory conditions in the pelvis. Neurotic phenomena are usually marked. Menstruation may be excessive at first, and afterward scanty.

DIFFERENTIAL DIAGNOSIS OF PELVIC INFLAMMATIONS.

It is generally impossible, by clinical methods, to determine, in a case of pelvic inflammation, the exact extent of tissues involved. As a rule, the disturbance is not confined to the structure in which it is first marked.

There is a considerable resemblance between the symptoms in the various affections, and differentiation by means of physical examination is often very difficult. Thus an acute ovaritis or an acute salpingitis may present the same clinical picture, and each of these may be accompanied with a pelvic exudate which alone may be palpable, the primary seat of the infection being indistinguishable.

The characteristics associated with pelvic cellulitis and peritonitis have already been detailed.

Hematoma and Hematocele.—The swelling caused by blood extravasation either in the pelvic cellular tissue or peritoneum may simulate an inflammatory mass. The condition develops suddenly but without chills or high temperature. Before coagulation of the blood its consistence may simulate that of a collection of serum; after clotting it is firm and elastic, but not so hard as an inflammatory exudate. There may be slight elevations of temperature, but these are not usually marked unless secondary infection of the blood-mass occurs. Apart from the pain which often accompanies the initial blood extravasation, there is not usually very much afterward. Frequently, in such cases, there are various signs and symptoms which point to ectopic pregnancy.

Salpingitis.—An inflamed, thickened, nondistended tube may usually be easily distinguished on bimanual examination if the patient's abdomen be relaxed. It is felt as a tender, elongated, or nodular mass, extending out from the cornu of the uterus. Ordinarily it cannot be palpated on account of pelvic tenderness and rigidity of the abdominal wall, and it may be impossible, without anesthesia, to determine anything accurately. In the case of a large distended tube the mass may be difficult to distinguish from a peritonitic or cellulitic swelling. In moderate degrees of enlargement it has the shape of a sausage or Indian club, but in extreme degrees it is more or less rounded. It may be behind the broad ligament on one side, or in the middle line behind the uterus. It is usually tense and elastic, and sometimes fluctuation may be obtained. The mesial swelling may push the uterus forward; the lateral swelling does not cause such displacement as that produced by a broad-ligament swelling. In old chronic cases inflammatory symptoms may be entirely absent. Also on bimanual examination no tenderness may be caused. When both tubes are affected, no line of

separation between them may be made out; frequently, however, a sulcus may be felt on rectal examination.

Ovarian Swellings.—An acute inflamed and enlarged ovary causes marked pelvic pain and cannot usually be palpated satisfactorily unless the patient be anesthetized. By the rectum a considerable portion of it may be outlined. A greatly enlarged ovarian abscess may be difficult to diagnose. It may be laterally or mesially placed, and is generally rounded, its wall being thicker than that of a distended tube. An ovarian cystoma, situated within the pelvis, if movable, is not likely to be mistaken for cellulitis or peritonitis. If, however, it is impacted in the pelvis, it may simulate a collection of fluid within the pelvic peritoneum. In such a case there is an absence of inflammatory signs and symptoms.

A pelvic ovarian cyst may be associated with peritonitis, and the latter may be so prominent as to mask the former. A solid ovarian tumor may have the consistence of an inflammatory exudate, but its lateral situation, its definite outline, and the absence of an inflammatory history suggest its true nature.

A broad-ligament cyst may easily be mistaken for an inflammatory collection. It is, however, of slow growth and does not cause pain or fever.

Ectopic gestation may simulate an inflammatory swelling under certain conditions, *e. g.*, when the gestation sac lies posteriorly and more or less fills the pelvis, and when pains have been present. Frequently there is an inflammatory reaction around the sac, and thus the entire swelling may be regarded as inflammatory. Ordinarily, however, the absence of marked febrile symptoms and the existence of various features associated with ectopic pregnancy suffice to establish the noninflammatory nature of the mass. Rupture of the gestation sac may sometimes be diagnosed as inflammation. In such cases internal hemorrhage is usually the prominent feature, and if this be marked, the clinical picture is entirely different from that of inflammation (see p. 269). When rupture is followed by a hematoma or hematocele, there may be a simulation of an inflammatory swelling. This has already been described.

Uterine Fibroid.—A fibroid extending outward from the uterus may simulate a cellulitic or peritonitic mass, especially when it grows into the parametrium. There is, however, no history of an inflammatory attack nor, usually, of pain. On physical examination the swelling is definite in outline and is often movable. The presence of other fibroid tumors, the increased depth of the uterine cavity, and a history of uterine hemorrhages suggest the nature of the swelling. Sometimes, however, fibroids may be associated with pelvic inflammatory swellings and the latter may easily be overlooked. Under rest, the latter tends to diminish in size.

Perityphlitis.—A localized exudate developing in connection with a diseased appendix may simulate the lateral swelling of a parametritis which has extended into the iliac fossa. In both cases the initial symptoms may be similar. In the case of parametritis there is frequently a history of pelvic infection following abortion, labor, operation, etc. In the case of the appendiceal exudate, there is not necessarily any such history; there is usually pain in the appendix region, and the exudate is at first usually above the pelvic brim. In some cases it extends more or less deeply into the pelvis, so that

a condition is produced which may closely simulate that caused by a pelvic infection.

Psoas Abscess.—This condition may form a pelvic swelling which may simulate a pelvic cellulitis or peritonitis. There is no history of pelvic infection; the onset is not acute; the course is chronic. There may be evidence of spinal disease. The swelling is not tender on pressure and is not hard. The thigh tends to lie flexed and rotated inward. A condition of hectic is usually present.

Malignant Disease.—Malignant growths external to the vagina and uterus may frequently simulate inflammatory deposits. There is, however, an absence of infection or of an acute onset. Bimanual examination does not usually cause pain. The slow development, irregular nodulated character of the swelling, progressive loss of weight, severe pains, and the absence of febrile signs and symptoms suggest malignancy. A careful search should always be made for the primary seat of the disease, *i. e.*, either in the pelvis or in some distant part. The interior of the uterus may require to be explored in order that scrapings may be examined.

Retroflexed Gravid Uterus.—This condition may be confounded with a pelvic peritonitic swelling, especially when the uterine body becomes impacted in the pelvis. Infection may occur in these cases, and there may be marked febrile disturbance. On careful examination the uterine swelling may be found to vary in consistence and the embryo may be palpated. When inflammation has taken place around the uterus, palpation may cause pain and the physician may thus be led to think that the entire mass is inflammatory. The softening and discoloration of the cervix and vagina, amenorrhea, and other signs and symptoms of pregnancy usually point to the latter condition. In all doubtful cases an examination should be made under anesthesia.

HEMORRHAGE.

As the result of ruptured blood-vessels, blood may be poured into the peritoneal cavity—*intrapерitoneal* hemorrhage—or into the tissues external to the peritoneum—*extraperitoneal* hemorrhage. In the former condition the blood may remain free or may become encysted. To the localized accumulation occupying the pelvic cavity the term *pelvic hematocele* has been applied, though in the widest sense it might also be applied to the former class of cases. The extravasated blood external to the peritoneum is known as *pelvic hematoma* or *false hematocele*.

INTRAPERITONEAL HEMORRHAGE

The rupture of vessels causing this form of hemorrhage is associated with various conditions, *e. g.*, rupture of the liver, spleen, pregnant uterus, ectopic gestation, aneurysm, varicocele, adhesions, gastric ulcer, slipping of a ligature after operation, etc. In the present connection attention will be given to the cases of hemorrhage which are of pelvic origin.

PELVIC HEMATOCELE.

This condition is most frequent in parous women in the active reproductive period—*i. e.*, between twenty-five and thirty-five.

Etiology.—It is of the utmost importance to bear in mind that hematocele is not a special disease to be classed with new-growths, displacements, and the other distinct affections which are included in the category of gynecologic affections. For a long period the subject was discussed solely from the standpoint of the swelling produced by the outpouring of blood in the peritoneal cavity, and during this era little attention was directed to the causes which might lead to the hemorrhage. Consequently, little advance was made in the direction of establishing a rational method of treating the condition.



Fig. 133.—Hematocele from ruptured tubal gestation.

Cases were treated by the physician mainly by rest and by the application of cold to the abdomen. If the patient did not die at once from the effects of the escape of blood, she was bound to undergo a long and tedious period of recovery, always being in danger of running risk from one or more important complications, *e. g.*, peritonitis, suppuration, etc. The really first important step that led to the importance of determining the etiology of intraperitoneal hemorrhage was the recognition of the frequency with which ectopic pregnancy was associated with this condition.

Virgués was probably the first to draw attention to this relationship, while Gallard did good service in urging its importance. Yet it is to Lawson Tait that the chief credit must be given for the marked changes in the views

held by the profession during recent years, as well as for the revolution which has been effected in the treatment of hematocele.

There can be no doubt that the most frequent cause of intraperitoneal hemorrhage in woman is the escape of blood from a pregnant tube. There is, however, some difference of opinion as to the percentage of cases in which this is the causal factor. Lawson Tait states that it is the cause in the great majority of cases. The following statistics are not quite in harmony with this view:

In 66 cases of hematocele observed by Veit,	16 only were due to ruptured ectopic gestation.
In 20 " " " Jousset,	9 " " " " " "
In 17 " " " Doubousquet,	5 " " " " " "
In 36 " " " Voison,	9 " " " " " "
In 7 " " " Engelhardt,	1 " " " " " "

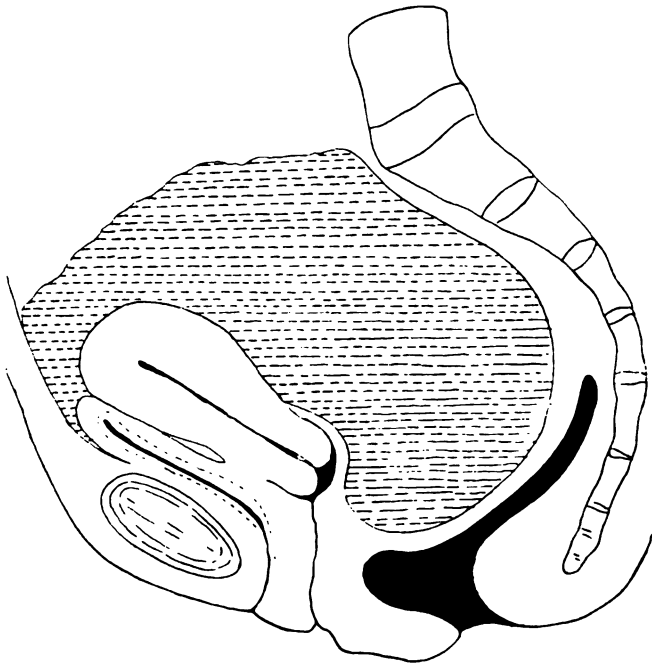


Fig. 134.—Hematocele from ruptured tubal gestation.

Thus, in 146 cases it appears that only 40, or 28 per cent., were due to ruptured ectopic pregnancy.

These statistics are, however, not at all conclusive. They do not exactly represent the conditions in the cases to which they refer, the percentage of ectopic gestations being undoubtedly too small. The clinical determination of tubal pregnancy by physical examination is generally difficult at all periods of gestation; in the early weeks an exact diagnosis, when hemorrhage has taken place, is often impossible. Consequently, in the above list, there were probably a considerable number of cases in which the pregnancy was neither recognized nor suspected. Exact statistics can be ascertained only by surgical or postmortem examination.

It is very interesting to compare the above list with statistics recently published by Cullingworth, based upon an experience gained by abdominal section. This authority reports an interesting series of twenty cases, in which he performed abdominal section for hematocele. In every instance the escape of blood was associated with tubal pregnancy. Until more numerous statistics are obtained in this careful manner, it will be impossible to speak with accuracy regarding the part played by ectopic gestation in the formation of hematocele.

A view long held as to the origin of many cases of hematocele is that of Bernutz, who regarded them as due to a reflux of menstrual blood from the uterus.

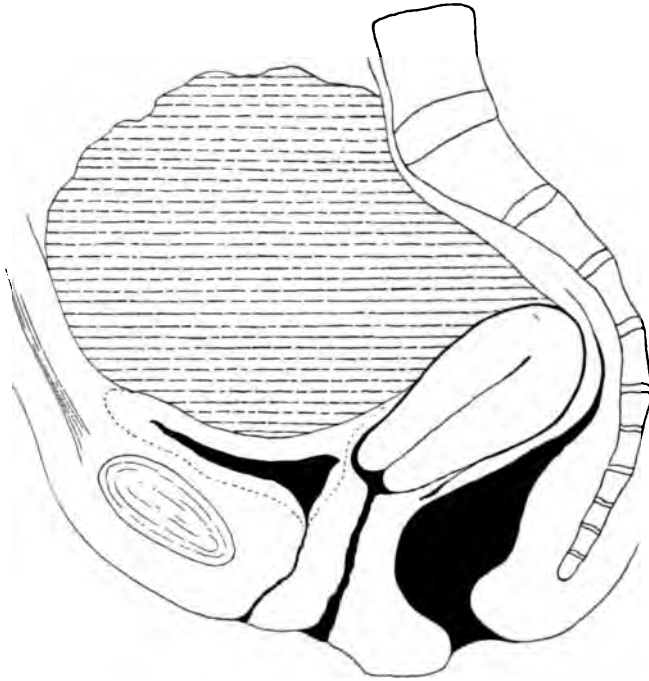


Fig. 135.—Hematocele from ruptured tubal gestation.

Many now believe that the cases of this supposed origin are mainly those in which tubal abortion has occurred, the supposed menstruation being the bleeding which may take place from the altered mucosa of the uterus in ectopic pregnancy. As there is only a slight escape from the uterus in such cases, it is easily understood how the belief has been readily accepted that the blood has regurgitated through the Fallopian tubes.

In cases where the hematocele forms without any external bleeding, the opinion has been often expressed that it is due to a reflux of blood from the tube apart from the influence of an ectopic gestation. All such opinions must be taken with caution. Cases must be examined with great care to ascertain the existence of ectopic gestation, and at the time of operation or

autopsy to make out the real source of the hemorrhage; above all, a microscopic examination of the tube and clots should be made to decide as to the presence or absence of fetal structures.

Hematocele may undoubtedly sometimes develop during menstruation where pregnancy can be entirely excluded. It has followed sudden strain or violent exertion. The source of the blood in such cases is uncertain. Sometimes it may occur in cases of cervical or vaginal atresia; the blood may then be both tubal and uterine.

A rare cause of hematocele is the rupture of a tumor, *e. g.*, an ovarian cyst in which hemorrhage has taken place. Gardner has described two interesting cases, in one of which the hematocele was associated with adenocarcinoma of the ovary, and in the other, with tuberculosis of a Fallopian tube, which had become distended with blood and had ruptured.

In other cases of hematocele it is believed that the blood may result from the rupture of a varicose vein, adhesions, Graafian follicle, hematosalpinx. Sometimes it may follow the bursting of a hematoma. Various diseases, *e. g.*, the acute exanthemata, purpura, scorbutus, hemophilia, may lead to such changes in the blood or vessel-walls as that rupture of the latter may easily occur.

Peritubal or Paratubal Hematocele.—This is a rare form of localized blood extravasation, first described by Säger, who considered it as caused by hemorrhage from the tube-lumen. Sampson Handley has recorded a case in which tubal rupture led to the condition termed by him "paratubal."

In peritubal hematocele the tube generally contains a mole, and the sac of the blood-mass surrounds the patent fimbriated end. Sometimes the hematocele may be both peritubal and paratubal. Mandl and Schmidt have described a case in which the tube, containing a mole, had ruptured, an encysted hemorrhage forming around the area of rupture, the portion of the tube between this point and the occluded ostium being inclosed within the sac of the hematocele. In another case of rupture the mole had partly protruded through the rent around which an encysted hematocele had formed. Sampson Handley has also described a case in which a mole escaped through the fimbriated end, a hematocele forming alongside the tube.

Pathologic Anatomy.—Sometimes the woman may die within a short time from the pouring out of a large quantity of blood into the peritoneal cavity. In cases in which death does not occur immediately, the following conditions are usually found:

The blood extends from the pelvis upward for varying distances. It may surround the uterus, push it forward, backward, or to one side. It becomes gradually clotted, forming a dark-red mass. Fibrin gradually spreads throughout it, and it becomes more organized, solid, and paler in color. (Many of the red blood-corpuscles are probably absorbed through the peritoneum early after rupture.) An inflammatory reaction usually occurs around the mass, and there is some serous effusion into the peritoneal cavity. The bowels become matted together, forming a roof over the blood-mass. Sometimes only the outer portion of the blood is solid, the central part consisting of one or more cavities containing altered blood, of a dark, tarry nature; or solidification may occur irregularly.

Course.—In many cases the blood gradually disappears by absorption.

Sometimes considerable thickening may remain for a long time. In some cases suppuration occurs, and a pelvic abscess is formed which may burrow in various directions. Sometimes the mass increases at menstrual periods, owing to increased hemorrhage or inflammation.

Symptoms.—These vary according to the rapidity with which the blood is poured out and to the quantity.

In a well-marked case there is sudden pain, accompanied, often, with a feeling of fear, pallor, prostration, collapse, perspiration, nausea, vomiting. The pulse becomes rapid and feeble. There is menorrhagia in some cases; sometimes the menstrual flow ceases, generally reappearing after a few days. In some cases anemia and amenorrhea may last for a considerable time.

The pains are often rhythmic; sometimes colicky. There is apt to be a recrudescence at succeeding menstrual periods. There may be a feeling of weight in the pelvis; also rectal and vesical tenesmus; sometimes, retention of urine; there may be jaundice, constipation, edema of the legs.

When inflammatory reaction occurs, the temperature and pulse rise, but the febrile state usually gradually subsides, unless suppuration follows, when its characteristic symptoms develop.

As the mass gradually shrinks and absorbs, the patient is more or less comfortable, though often some degree of pelvic discomfort or pain is experienced. There is generally a tendency to constipation; sometimes diarrhea and passage of bloody mucus occur.

Physical Signs.—When abundant blood is poured out, signs of free fluid in the peritoneum are present; *per vaginam* a feeling of bogginess is often detected through the fornix. As coagulation occurs the outline of a mass may be distinguished. At first it is difficult to feel this through the abdomen, owing to the tenseness and tenderness of its wall. Afterward it may be made out bimanually as a firm, elastic swelling, filling the pelvis and reaching up toward or above the umbilicus. The lower surface of the mass is somewhat concave. The uterus may be felt anteriorly against the symphysis, behind or laterally displaced; sometimes it may not be found at all, being in the midst of the blood. On percussion over the abdomen there is dullness over the palpable portion, which may extend higher on one side than on the other. As the case advances the mass becomes harder, and furrows often develop on it. Its consistence may be felt to vary at different parts. In some cases there may be slight distention of the intestines above it.

Differential Diagnosis.—1. Hematoma.

2. Pelvic peritonitis or cellulitis with exudate.
3. Myoma uteri; myoma with peritonitis or cellulitis; myoma with torsion of pedicle.
4. Ovarian tumor; tumor with peritonitis; tumor with twisted pedicle.
5. Posterior displacement of a gravid or nongravid uterus.
6. Hematosalpinx.
7. Retained menstrual blood in atresia of vagina or cervix or in the horn of a malformed uterus.

Prognosis.—After the encapsulation of extravasated blood, even very large in amount, recovery tends to take place, though in the majority of cases it is usually slow, extending over a period of weeks or months. Death may,

however, occur within the first few days after the primary rupture, or later if further bleeding takes place. Sometimes, extensive peritonitis or suppuration in the hematocele causes death.

Treatment.—In the past, treatment has been conservative in nature in the great majority of cases. The patient is kept absolutely quiet in bed, with the head low. If collapse be marked, a quart of normal hot saline solution should be injected high in the rectum or be administered under the breasts, hot-water bottles being applied to the feet. Brandy, ether, or strychnin may be given by the mouth or hypodermatically. Sometimes morphin is necessary. A coil through which ice-water circulates should be placed on the abdomen unless the vitality is very low. For the first few days a pint of normal saline solution is injected into the rectum, in the morning and evening. The diet should be chiefly liquid during this period.

Later, solid food may be given and also iron tonics. The bowels should be kept regular. In order to promote absorption, many authorities have recommended the inunction of ichthyol, iodin, iodid of potassium, or mercury ointment, together with a compress, but it is doubtful if these are of any value. The galvanic current has also been employed, the negative pole being in the vagina, and a large positive electrode on the abdomen.

Surgical Measures.—The exact position of surgical procedure in recent cases of hematocele has not been definitely fixed. The reason of this is our uncertainty in regard to all the causes which may give rise to the condition. Within recent years recognition of the importance of rupture of an ectopic pregnancy as a cause has led to early active interference. It is extremely likely that, in the future, similar measures will be adopted in all cases of intraperitoneal hemorrhage, whether the cause be known to be ruptured ectopic gestation or not (unless it be of such a nature as to preclude the possibility of remedial surgical interference, *e. g.*, rupture of a large aneurysm), provided that expert surgical aid is obtainable. Previous to operation a considerable quantity of normal saline solution should be injected under the breasts. Arrangements should be made for keeping the patient warm; an electric pad, where it can be obtained, is valuable for this purpose.

The smallest possible quantity of anesthetic should be employed during the operation. After the abdomen is opened, an immediate search should be made for the bleeding vessel. It may be necessary to remove much blood-clot before this can be accomplished. When the ruptured area is found, bleeding should be checked with forceps or ligatures. When the bleeding is from an ectopic gestation sac, immediate clamping of the infundibulopelvic ligament and of the broad ligament close to the uterus, on the affected side, should be carried out. The gestation sac may then be dealt with according to the conditions present. Before the abdomen is closed, all blood-clots should be removed, and the cavity thoroughly irrigated with normal saline solution (106° F.), some being left to be absorbed.

Drainage should not be carried out unless it is believed that infective material has entered the peritoneal cavity, or unless the nature of an ectopic gestation demand this procedure. It should be carried out through the posterior fornix of the vagina by means of gauze, unless there is some special indication for draining through the abdominal incision.

In later stages of a hematocele, where absorption progresses very slowly,

it may be advisable to open the mass and remove the clot. This should be carried out through a posterior vaginal incision. The clot may be removed with the fingers and by irrigation with normal saline solution. Afterward the cavity is packed with chinosol gauze. This is renewed two or three times at intervals of two or three days. Thereafter, daily irrigation with formalin solution (20 drops to 1 pint) is carried out.

When an abdominal incision is necessary, the clots should be removed, chinosol gauze should be introduced into the lower part of the cavity, and carried into the vagina through an opening made in the pouch of Douglas. This is preferable to the method of draining through the abdominal incision, though the latter may sometimes be necessary. The after-treatment is the same as indicated above.

Hematocoe of Some Duration, in which Suppuration has Occurred.—The treatment consists in opening into the mass, removing the pus and the clot, washing out the cavity with an antiseptic, and draining it freely. The place of opening in such a case must depend on circumstances. The operator must be guided by the position and extent of the pus, by the direction in which it is tending to point, by the relationships of the intestines, and by the necessity of selecting the best route for drainage.

There can be no doubt that the vaginal opening is the best when most of the blood-mass is broken down and can be removed. When the mass is of small size this procedure affords the best means of drainage. When it is large and not much disintegrated, it may be necessary to make an opening in the abdominal wall, directly over the pus-collection. As much of the mass as will easily come away should be removed, and the cavity packed with chinosol gauze. In all these cases care must be taken not to injure the intestines. They are generally matted together to form the upper boundary of the hematocoe, which is thus shut off from the rest of the peritoneal cavity. Vaginal drainage suffices for the majority of these cases. The abdominal route should be used only when the former is not accessible or is not considered sufficient.

PELVIC HEMATOMA.

Hemorrhage into the extraperitoneal cellular tissues of the pelvis is due to the same causes which produce hematocoe. The blood goes through the same changes as those already described. In most cases the amount extravasated is not large, but several pints may sometimes be found in the swelling, which may reach several inches above the pelvic brim.

Symptoms.—These are somewhat similar to those occurring in hematocoe, but are much less severe. There is rarely any rise of the temperature following the hemorrhage.

Physical Signs.—When the effusion has taken place in a broad ligament, the uterus is pushed toward the opposite side of the pelvis, the vaginal fornix on the corresponding side being bulged downward. Through the abdominal wall the upper surface may be very clearly defined, and, sometimes, the appendages may be felt against it.

Sometimes the blood extends all around the uterus, causing a downward bulging of the whole vaginal fornix. In some cases the perirectal tissue may be the seat of a hemorrhage, and a mass may be found which is lateral

to the gut or which presses forward in front of it, displacing the uterus. Sometimes a hematoma ruptures into the peritoneal cavity.

Prognosis. — Recovery occurs in most cases. Secondary rupture into the peritoneal cavity is rare. Suppuration may take place. The most important condition is the rupture of an ectopic gestation into the broad ligament; though usually the ovum is destroyed, in some cases it continues to grow. All cases should, therefore, be carefully considered in relation to such a contingency (see p. 644).

Treatment. —

Most cases may be treated on the conservative lines described in connection with hematocele.

When absorption proceeds very slowly, the mass may be incised through the vagina, if it be easily accessible, the clot being removed and the cavity packed for a few days with antiseptic gauze, and afterward treated by vaginal irrigation.

When the hematoma is due to the rupture of a tubal pregnancy, the ovum continuing to develop, surgical measures are indicated (p. 670).

When a hematoma ruptures into the peritoneal cavity, the abdomen should be opened, and the cause of the hematoma investigated. If an ectopic pregnancy be present, the procedures should be those described in chapter XXI. If there be no ectopic gestation, the blood-clot should be removed from the



Fig. 137. — Sagittal lateral section of pelvis showing hematoma of left broad ligament.

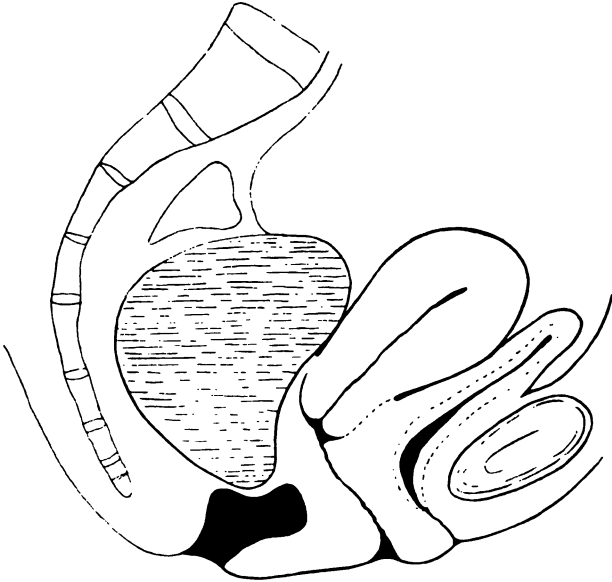


Fig. 136. — Extraperitoneal hemorrhage in the region of the rectum.

broad ligament, and all bleeding points secured with catgut ligatures. Usually

it is advisable to tie the ovarian vessels in the infundibulopelvic ligament. It may also be necessary to remove the ovary and tube on the affected side,

placing ligatures on the uterine vessels close to the uterus. The layers of the broad ligament may then be turned inward so that the cavity may be closed with continuous catgut suture.

Sometimes it may be considered advisable to pack the cavity with antiseptic gauze, whose lower end is carried into the vagina. Many operators after cleaning out the peritoneal cavity stitch the hematoma sac to the abdominal incision, an opening being made in the sac in order that the cavity may be packed with gauze. Such a method necessitates a tedious recovery and a weak abdominal wall.

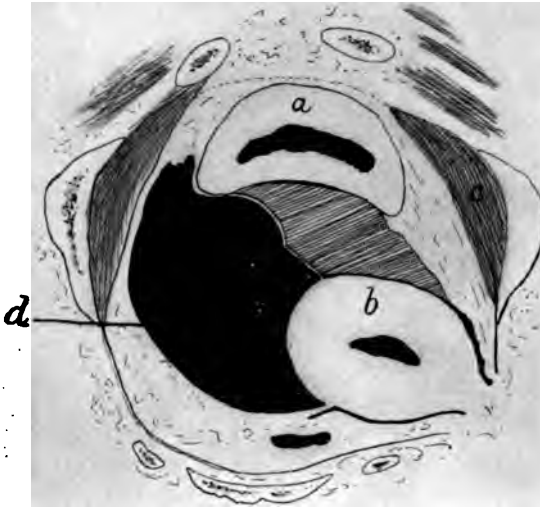


Fig. 138.—Transverse section of pelvis showing left extraperitoneal hemorrhage from rupture of tubal gestation: *a*, Bladder; *b*, uterus displaced; *c*, obturator muscle; *d*, blood.

When suppuration takes place in a hematoma, the condition is treated as cellulitic abscess (p. 277).

OTHER AFFECTIONS OF THE PELVIC CONNECTIVE TISSUE.

CYSTS OF THE BROAD LIGAMENT.

Small Cysts.—The hydatid of Morgagni, a small cyst developed from the outer end of the horizontal tube of the parovarium, has already been described (p. 79).

Small cysts, rarely larger than a pea, may develop from the short tubules (Kobelt's) of the organ of Rosenmüller external to the ovary. They may also develop from other remains of the Wolffian body in the broad ligament. They are lined with low epithelium or with cylindric ciliated cells. Sometimes muscle-fibers are found external to the cells, and pigment bodies are sometimes present in them. They have the same origin as the cysts described in adenomyomata of the uterus by von Recklinghausen.

Kossmann states that accessory Müllerian ducts may give rise to many small cysts. Sampson Handley, in a recent paper, has clearly demonstrated the origin of certain cysts of the broad ligament situated above the tube from accessory Fallopian tubes. He believes that the same is true as regards cysts situated below the tube, though proof is not yet forthcoming. The

possibility of a tubal origin was first suggested by A. Doran in 1884. Handley has described a supratubal cyst communicating with the Fallopian tube.

He believes that these cysts are derived from persisting remnants of the pronephric funnels attached to the posterior part of the early Müllerian duct. According to him, the hydatid of Morgagni is probably the lowest of the three funnels.

Handley has noted the similarity of some of these small cysts to a hydrosalpinx in shape and structure; on the inner wall he finds plicæ which he considers as distinctly tubal.

With regards to the cysts described ordinarily as parovarian, Kossmann believes that they are developed from accessory Müllerian structures, and he would apply the term *sacro-parasalpinx serosa* to them. This view is not, however, held by many others.

Large Cysts (Parovarian).—These are ordinarily regarded as developing from tubules of the parovarium between the longitudinal duct (Wolffian) and the ovary.



Fig. 130. —Diagram illustrating the persistent Wolffian duct in Kœberlé's case.

They are rare before puberty, though many are found in the early years of womanhood. They may, however, develop at any period afterward.

They are almost always unilocular. Sometimes more than one may be found side by side in the broad ligament. The wall is thin and often translucent. The peritoneal covering is somewhat movable on the surface, and contains numerous vessels. It may usually be stripped from the cyst with ease. The main thickness of the wall is fibrous tissue. Smooth muscle-fibers may also be found in it, being usually irregularly distributed in it. They may be derived from the muscular tissue belonging to the primary tubule or to the broad ligament. The lining in small cysts consists of columnar epithelium ciliated in parts; in large cysts it is compressed and may be cubic or flattened. Sometimes, there may be more than one layer of cells. Projections may sometimes be found in the inner wall; these are regarded by von Recklinghausen as derived from lateral diverticula of the parovarian tubules.

The fluid is thin, limpid, and alkaline, with a specific gravity of 1002—

1008. It contains little proteid matter, but occasionally there is paralbumin. In large cysts the fluid may be turbid and may contain cholesterin. Sometimes, a fluid of high specific gravity is found.

As the cysts grow, the Fallopian tube is stretched over it and elongated, its wall being thinned. The ovary is drawn toward it, and may be closely applied to it, or may become greatly stretched and flattened, appearing as a mere thickened portion of the cyst-wall.

The cyst grows slowly, and may be stationary for years, giving no trouble. They tend to rupture spontaneously, the fluid being quickly absorbed. The growth reaches a very large size.

The process of refilling occurs slowly after rupture or puncture, *e. g.*, months or years may elapse. Adhesions are not often met. Torsion is rare.

The cysts may burrow beneath the peritoneum and may pass beneath the pouch of Douglas to the opposite side, or may reach rectum, cecum, or colon.



Fig. 140.—Parovarian cyst developing extraperitoneally, displacing uterus and vagina laterally.

They may lie in contact with bladder, uterus, and pelvic floor. Thus these various structures may be considerably displaced.

These cysts are usually nonpedunculated, but a pedicle may form, owing to the bulging of the tumor posteriorly.

Papillomatous Cysts.—These are unilocular, and contain on their inner surface papillary projections, similar to those described in papillomatous cysts of the ovary. They develop extraperitoneally, as has been described in the case of parovarian cysts. Their significance is the same as that of papillomatous cysts of the ovary. They originate from remains of the Wolffian body or duct within the broad ligament.

There is one variety in which the projections are very hard, differing from the soft, vascular, papillary projections so characteristic of the common papillomatous cyst.

Diagnosis.—Small cysts are clinically of no importance, being discovered ordinarily only during abdominal operations or at autopsies.

Parovarian cysts of moderate size if pedunculated may remain a long time undiscovered. When very large, they cause distention of the abdomen.

Large cysts which are not pedunculated and develop extraperitoneally may cause pelvic distress, and symptoms usually arise in connection with the displacement of organs and pressure upon them. Thus there may be disturbances of micturition or defecation. Rupture of the cyst sometimes occurs, spontaneously or due to accident. This may cause no symptoms, though diuresis sometimes results. Rarely, there is pain, shock, or evidence of intra-abdominal hemorrhage. If any infective condition be present, general peritonitis may develop.

The large swelling causes distention of the abdomen, the physical signs being similar to those found with large ovarian cysts, except that the swelling is rarely as tense as the latter. Indeed, the sac is frequently so flaccid that its outline cannot be palpated.

On bimanual examination the bulging of the tumor may usually be felt, though when the cyst is not tense, it may not be detected. When it is extra-peritoneal, displacement of the uterus and bladder may be distinguished. When the intestines are raised over it, a tympanitic note may be obtained on percussion over a large area of its anterior surface. No nodules are felt like the small cysts in an ovarian cystoma.

Treatment.—Large parovarian cysts should be removed by abdominal section (see p. 404).

Intraligamentous Ovarian Cysts.—These are described on p. 380.

SOLID TUMORS OF THE BROAD LIGAMENT.

Fibroma and **myoma** may develop in the broad ligament independent of the uterus. The same degenerations which occur in uterine fibroids may be found in them. Some of the cystic tumors are undoubtedly of the same nature as the uterine adenomyomata described by von Recklinghausen, in which the cysts are developed from remains of the Wolffian body. They are usually lined with ciliated epithelium.

Lipoma of the ligament is rare.

These tumors develop slowly. They are usually nonpedunculated, and as they grow, tend to displace neighboring structures and to cause pressure symptoms.

Treatment.—Removal should be carried out by abdominal section. The ovarian vessels should first be ligated. An incision should then be made through the anterior peritoneal covering of the tumor, *i. e.*, the broad ligament. The swelling is then shelled out, care being taken to avoid injury to the ureter or important vessels. Sometimes it is advisable to split the tumor and to remove it in portions. Bleeding points may be secured with catgut. It is sometimes necessary to tie the uterine artery near its origin. When the hemorrhage is controlled, the layers of the broad ligament should be turned into the cavity and stitched together with catgut. Salpingo-oophorectomy on the affected side is advisable in the case of removal of a large tumor. Drainage through the abdominal incision or into the vagina, formerly considerably practised, is rarely ever advisable.

Primary sarcoma of the broad ligament is very rare, and is usually discovered only when radical removal is impossible.

Carcinoma is probably always secondary, though it has been sometimes described as primary. **Dermoid tumors** are rare.

SOLID TUMORS OF THE ROUND LIGAMENT.

Fibroma, fibromyoma, fibromyxoma, and **sarcoma** may develop in the round ligament and may be found within the abdominal cavity, in the inguinal canal, or in the labium majus. In some cases the fibroids resemble the uterine adenomyomata described by von Recklinghausen, containing gland-like structures and cysts; these are probably derived from remains of the Wolffian body. They may be unilateral or bilateral, mostly the former. H. Spencer says that uterine fibroids are associated with them in 50 per cent. of cases. They are subject to myxomatous, lymphangiectatic, and calcareous changes.

Treatment.—The extraperitoneal growths may be removed by external incisions in the groin, unless too extensive infiltration of neighboring tissues has occurred. The intraperitoneal forms may be removed through an abdominal incision unless they have spread too extensively.

Hydrocele of the Round Ligament.—This is a collection of fluid in the canal of Nuck—a tube of peritoneum extending into the labium majus. It may communicate with the peritoneal cavity or be shut off at the internal inguinal ring. It must be diagnosed from an ovary prolapsed into the inguinal canal and from inguinal hernia. When it exists as an encysted hydrocele, there is an oval, translucent swelling in the inguinal canal. It cannot be pressed into the abdomen, is not tender, and causes no symptoms. When it is in the labium majus, the latter is distended with a fluctuating swelling, sometimes translucent, which cannot be returned into the abdomen.

Treatment.—The most satisfactory treatment is to cut down upon the cyst and dissect it out, closing the wound with continuous catgut suture. If the cyst communicate by an unobliterated passage with the peritoneum by means of the inguinal canal, it is well, after dissecting out the sac, to place a ligature immediately above it in order to close the passage in the inguinal canal.

The wound is then closed with continuous catgut.

Tumors in the Pelvic Connective Tissue Elsewhere than in the Broad and Round Ligament.—Dermoid cysts, fibroma, fibromyoma, and sarcoma may be found, *e. g.*, in the rectovaginal septum, at the side of the rectum, etc. Adenomata and cystadenomata, derived from remains of the Wolffian body, may sometimes develop on the posterior wall of the pelvis or lower abdomen.

PELVIC VARICOCELE.

Varicose vessels are not infrequently found in the broad ligaments, veins belonging either to the ovarian or uterine vessels being affected. In the author's experience branches of the ovarian vein in the broad ligament have been most often enlarged, especially on the left side. Sometimes both ovarian and both uterine vessels may be involved at the same time. The veins of the vulva, rectum, or lower limbs may also be affected.

The condition may be associated with chronic venous congestion and

enlargement of the uterus, leading to excessive discharge of blood from this organ. Enlargement of the ovary with engorgement of vessels and edema and cystic degeneration may also be produced; A. P. Dudley and Petit state that in old-standing cases sclerosis and atrophy result.

Etiology.—The condition is most common in women who have borne children. The enlargement of the veins in pregnancy may never have entirely disappeared, owing to some weakness in the vessel-walls, to general weakness, or overexertion. Posterior or downward displacement of the uterus may sometimes favor the development. Chronic constipation may in some cases cause interference with the flow of blood by the pressure of fecal masses. Enlargement of the veins is frequent in connection with large tumors, especially fibroids. The left ovarian vein is most easily obstructed because there is no valve in it, and because it opens into the left renal vein, forming a right angle with the latter. Janni states that in some cases of varicocele there are thickenings of the intima which obstruct the flow of blood. Zinke thinks that among the causes should be cited increased intra-abdominal pressure of every kind. Diseases of heart, lungs, and liver should also be mentioned. Michel and Bichat suggest as another cause infection during the puerperium producing lymphangitis in the tubo-ovarian pedicle, with extension to the veins, causing periphlebitis and subsequent distention. Aneurysmal varix is rare; according to the last-mentioned author, traumatism, *e. g.*, violence, application of forceps in labor, and other operations, is a necessary factor. Rupture of varicose pelvic veins is a very rare occurrence.

Diagnosis.—In most cases varicocele cannot be definitely diagnosed. Sometimes the presence of varicose veins in the leg leads to the suspicion that a similar condition exists in the pelvis. In some cases the varicocele may not be sufficiently marked to cause symptoms. Frequently, however, these are present. A. P. Dudley, who was the first to direct special attention to this condition in this country, has pointed out their similarity to those found in varicocele in the male. There is a dull, aching pain in the pelvis, which may be felt in the back. It is often aggravated by standing, walking, or lifting, and eased when the patient lies down. In some cases there is menorrhagia or metrorrhagia. Reflex nervous phenomena and depressed health may be more or less marked. On bimanual examination it is usually impossible to determine satisfactorily the existence of varicocele, though in some cases a swollen condition of the broad ligament may be made out; the mass is compressible, and may be described as having a doughy consistence. If thrombi are present in the veins, irregular thickenings are distinguished. Phleboliths may be felt as hard masses. In the great majority of cases varicocele is accidentally found in the progress of an abdominal section for other pelvic disease.

Treatment.—Owing to the scant attention which has been given to varicocele in the female and to the difficulty of diagnosing the condition with accuracy, little can be said concerning treatment. In a suspected case of recent origin it is probable that improvement will follow if the patient avoids long standing, walking, or lifting, and rests on her back for a while every day, at the same time keeping the bowels well regulated. Hot vaginal douches and glycerin tampons are also recommended. In an old-standing case such therapy is useless. Surgical interference has been practised by several operators, but no definite rules can be established for its application.

When the varicocele is marked and is limited to the ovarian vein and pampiniform plexus of one broad ligament, ligation of the ovarian vessels external to the tube and of the upper part of the broad ligament internal to the ovary, together with removal of the corresponding tube and ovary, may be practised with satisfactory results. If the uterine vein on the same side is affected, it may be ligated along with the uterine artery close to the uterus. In ligating varicose veins they may tear and give rise to troublesome hemorrhage. If the ovarian vein is chiefly affected and the ovary be little altered, it may suffice to ligate the vessel in two places and divide or remove it.

When both ovarian veins are affected, they should be ligated and both ovaries and tubes should be removed, if the patient be near the menopause. If this course is not permitted, removal and ligation should be practised on the side which has the most marked varicocele. On the other side the ovarian vein should be doubly ligated and divided.

When both ovarian and uterine vessels are much involved, it is probably most satisfactory to remove the uterus and appendages. In one case the author ligated both ovarian vessels and the uterine vessels of one side, close to the uterus, without removing anything, the result being satisfactory.*

*An interesting paper on this subject is that of Miller and Kanavel, in "Amer. Jour. Obstet.," vol. li, No. 4, 1905.

CHAPTER IX.

INJURIES AND DISPLACEMENTS OF THE PELVIC FLOOR.

INJURIES OF THE VULVA AND VAGINA.

These may result from coitus, parturition, or other forms of trauma. There may be superficial abrasions, lacerations, or contusions. Vulvar lacerations are not infrequent in labors. The first coitus usually tears the hymen, though it may not. The laceration ordinarily is slight, but it may extend into the vestibule, labia, vaginal wall, or perineum. Rarely, the whole hymen may be torn away. Extensive ruptures occur when coitus is very violent, when there is much disproportion between the penis and the introitus vaginæ, or when the female parts are nonelastic, as after middle life.

In first labors the hymen is markedly stretched and usually torn; in rare instances retraction and healing may take place afterward to such an extent as that it may be difficult to be certain that labor had ever occurred.

Slight tears are not infrequent in the anterior vulvar region, *e. g.*, the vestibule; they may extend to the clitoris or urethra. The labia minora and majora may also be lacerated in labor, chiefly in instrumental deliveries. Excessive hemorrhage may result.

Vaginal Laceration.—Though the vaginal wall is greatly stretched and thinned in labor, it is rarely torn except in the region of the perineum, owing



Fig. 141.—Rupture of perineum associated with loss of control of the bowel.

to the elastic support afforded by the tissues packed between it and the bony pelvic wall.

Next in frequency to the perineal portion the upper end is most likely to be torn, being in a considerable percentage of cases a continuation of a cervical laceration. The rent varies considerably as regards size, shape, and direction. It may involve only the vaginal wall, or may extend into the

paravaginal tissues, sometimes reaching the bony pelvis. Occasionally the bladder, rectum, urethra, ureter, or peritoneum may be involved. Sometimes a circular laceration may separate the cervix partly or entirely from the vagina. Isolated lacerations of the vagina not continuous with those of the cervix or perineum are very uncommon. Their direction is usually more or less vertical.

The conditions favoring vaginal laceration are deficient elasticity, increased toughness of the connective tissue, cicatrices in the wall resulting from old tears, operations, or inflammation, marked disproportion between fetus and genital passage, instrumental or manual deliveries.

Of great importance in the study of the lesions associated with the distention of the vagina in labor is the stretching of the visceral layers of the pelvic fascia, viz., the vesicovaginal, rectovaginal, and anal, and the separation of the lateral halves of the levator ani



Fig. 142.—Drawing of a cast of the perineum of a woman who had incontinence of gas and feces. There was no external evidence of injury of the sphincter.

muscle. In many cases retraction occurs afterward only imperfectly, so that the function of these tissues as a supporting framework is more or less affected. The impairment is increased if, in addition, there is much laceration of fibers of the fasciæ or muscle.

Symptoms.—Lacerations are followed immediately by more or less hemorrhage. When large veins are torn, it may be very dangerous to life. Contusions may lead to the formation of blood extravasation in the tissues.

These may become absorbed, but sometimes become infected, leading to abscess-formation, or may be associated with gangrene of the injured tissues.

When the bladder or bowel is torn as well as the vagina, a fistula is established.

Treatment.—Slight vaginal lacerations, if caused during labor, require no special treatment. Extensive lacerations should always be sutured, under strict aseptic precau-

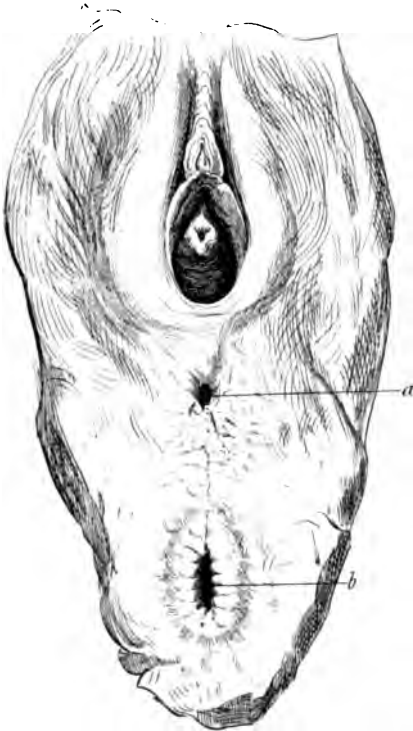


Fig. 143.—Central rupture of the perineum. Through this opening a child had been delivered: *a*, Central rupture; *b*, anus (Sir J. Y. Simpson).



Fig. 144.—Tongue-like projection of posterior vaginal wall in a woman injured by labor.

tions. When not produced during labor, daily antiseptic douches should be given after repair. When the wounds are in the vulva, pads soaked in an antiseptic solution (formalin, 20 drops to a pint) should be applied to the parts for several days.

LACERATIONS OF THE PERINEUM.

Though this expression has long been in use, it is liable to be misinterpreted. The perineal body should not be studied as a separate entity. It is merely the anterior portion of the sacral segment of the pelvic floor, and is a complex structure, composed of different fascial and muscular structures.

Of these, the most important are the following: posterior portion of the triangular ligament, anterior and posterior layers; rectovaginal visceral

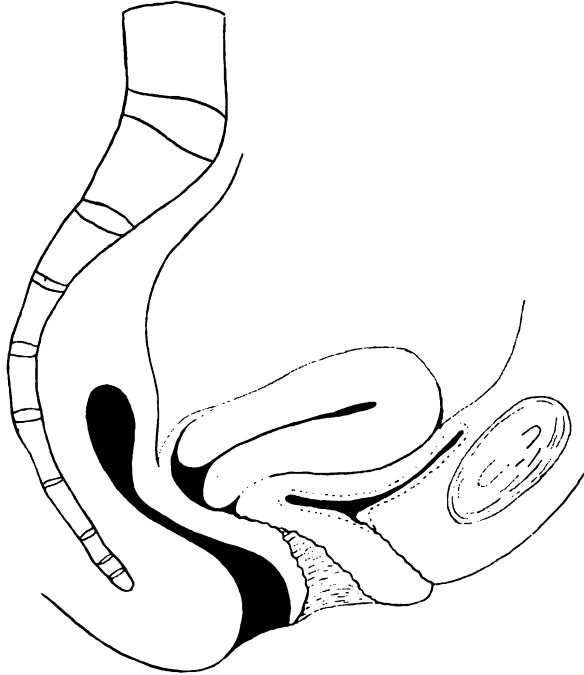


Fig. 145.—Vertical mesial section of a multipara, showing rupture of perineum.



Fig. 146.—Extensive complete perineal rupture following labor.

fascial layer, anal fascia, and deep superficial fascia. The muscles that meet in the perineum are the transversus perinei profundus, small offshoots of the levatores ani, sphincter vaginæ, and sphincter ani.

The significance of the laceration depends upon the extent and number of these various structures divided.

In all first labors the fourchet, in front of the perineum, is torn. Frequently, as well, the lower part of the vaginal mucosa is involved. The tear may be mesial, but more often extends up one or both sulci, and may be higher on one side than on the other. A bilateral laceration leads to the separation of the posterior vaginal mucosa in a tongue-shaped portion. These lacerations may extend into the levator ani and fascial layers. They may extend downward and backward toward the anus, and in the worst cases



Fig. 147.—Rupture of perineum with cystocele.

may involve the anterior wall of the latter with part or the whole of its sphincter muscle. Frequently the various tissues are torn subcutaneously, with little or no external laceration.

Rarely the perineum, so called, may be ruptured between the anus and the anterior margin. This central rupture may be complete or incomplete, and may occur spontaneously, or may be due to injury with instruments; the child may or may not be delivered through the laceration.

Etiology.—The following are the chief causes of rupture: large head or body of the child; precipitate labor; rigidity of the tissues; excessive soft-

ness caused by edema; improper use of instruments; introduction of the hand without previous dilation; delivery of persistent occipitoposterior or face cases; narrow subpubic angle, straight sacrum, and excessive antero-posterior length of perineum. Laceration is favored by flexion of the thighs on the abdomen during the birth of the fetus; the more the thighs are extended, the more the perineal tissues are relaxed.

Results of Rupture.—All tears of the perineum are to be regarded as serious, not only because of the risk of infection of the raw surface, but because



Fig. 148.—Complete tear of perineum, dividing the anal sphincter. The torn ends of the latter have retracted laterally, being indicated by skin-dimples.

of troubles that may arise afterward from the weakness produced in various elements of the supporting framework of the pelvic floor; and, in complete lacerations, from partial or complete interference with the sphincters of the anus. Hemorrhage results from tearing of the perineum, but it is rarely excessive. Partial ruptures heal by granulation and consequently tend to shrink somewhat afterward.

Treatment.—The prophylactic measures to be observed in labor for the prevention of rupture of the perineum are described in works on obstet-

rics. Slight tears that involve only the skin should not be sutured unless the procedure can be carried out aseptically. Deeper tears should always be stitched at the end of labor, if the operation can be properly performed. If the light be poor, the assistance limited, and the facilities scanty, or if thorough asepsis cannot be assured, the procedure should be postponed for a few hours (not later than twelve) until it can be thoroughly carried out. In the interval dressings soaked in an antiseptic solution should be continuously applied to the vulva. It has been successfully carried out several hours later than the period mentioned, but the chances of poor union are greater the



Fig. 149. Repair of partial rupture of perineum by flap-splitting method. The line of incision is shown.

longer the delay. If the operation cannot be well performed within twelve hours of labor, it should be postponed for seven or eight weeks.

Operation Immediately after Rupture.—In repairing a laceration, the patient should be placed in the lithotomy position, the genitalia being cleansed and protected with sterile coverings. If the tear be superficial or of medium depth, a series of interrupted stitches should be introduced along the wound from the upper to the lower end. Each should enter the skin 0.5 cm. external to the tear, and should be carried deeply under the raw surface, emerging at a

point in the skin opposite the place of entrance, care being taken to avoid the rectum.

Thoroughness is necessary in performing this operation, in order that the wound may be closed in its entire depth, and not at the skin-edges only. The suture material may be silkworm-gut, chromicized gut, impermeable linen, or silk. Moist antiseptic dressings should be kept on the vulva for several days after the operation. Catheterization of the bladder should not be carried out unless the patient cannot urinate spontaneously. The bowels



Fig. 150.—Repair of partial rupture of perineum by flap-splitting method. The flap formed by the posterior vaginal wall is raised, showing the large raw area produced.

should be kept regularly open, straining at stool being avoided. In cases in which the laceration involves the anus, the edges of the rent in the latter are first closed by a fine, running chromicized catgut suture, tied in the lumen of the bowel. The ends of the torn sphincter muscles, which are usually retracted, should be lifted up with forceps and stitched together with some variety of catgut which is absorbed moderately quickly, *e. g.*, formalin gut. The rest of the wound is then closed with a series of interrupted silkworm-gut or silk sutures in the manner just described in speaking of partial tears.

After the operation the patient's knees are tied together for several days.

Moist antiseptic dressings are continuously applied to the perineum and vulva for four or five days. A piece of antiseptic gauze is placed in the vagina and removed on the third day. Thereafter the vagina is douched daily with an antiseptic normal saline solution containing formalin (25 drops to a pint). The bladder may require to be emptied with a catheter. The bowels need not be moved for four days. On the evening of the fourth day a laxative is administered. On the morning of the following day a mixture of olive-oil (2 oz.) and glycerin (1 oz.) should be carefully injected into the rectum by the



Fig. 151.—Repair of partial rupture of perineum by flap-splitting method. The raw area has been closed with continuous catgut suture and the skin-edges with interrupted silkworm-gut.

medical attendant, in order to soften the feces. The same precaution should be taken two days later when the bowel is again emptied. In moving the bowels the patient must not strain. Nonabsorbable sutures may be removed ten days after the operation.

The patient should be in bed until the fifteenth day, or longer, if healing be not satisfactory.

Old-standing Rupture.—(a) *Where the anus is not included in the rupture*, and where there is no rectocele, the following operation is highly satisfactory:

The patient is placed in the lithotomy position, having been carefully prepared beforehand. If there is any doubt about the sterility of the uterine cavity, it should be curetted as a preliminary measure. With a pair of angled scissors, a horseshoe-shaped incision is made close to the introitus vaginæ, the sides of the incision running on the inner surface of the labia majora.

The incision is extended upward into the tissues about an inch. The anterior flap is then drawn forward, and the edge of the posterior flap backward, by volsellas.



Fig 152.—Repair of complete tear of perineum (Fig. 148) by flap-splitting method. The line of incision is indicated.

In this way a gaping, lozenge-shaped raw surface is produced. This is closed from side to side by a continuous formalin catgut suture (No. 3), carried in several stages from the deepest portion of the wound to the surface. The skin-edges may be closed with silkworm-gut or chromicized catgut.

An equally satisfactory method of closure is by means of interrupted silkworm-gut sutures, no buried catgut being used. In cases in which there is a large gaping vulvar orifice, a triangular portion of the anterior flap may be

removed (see Fig. 157). The raw edges are then sutured with chromicized gut, the remainder of the operation being as just described.

A strip of antiseptic gauze is then placed in the vagina. Dressings soaked in antiseptic solution are applied to the vulvar region.

After-treatment.—The patient is allowed to urinate spontaneously, the catheter being used only when necessary. The moist antiseptic dressings are constantly applied for a week or ten days. The knees are tied together



Fig. 153.—Repair of complete tear of perineum by flap-splitting method. The vaginal flap is shown, having been carried forward. The two small anal flaps are seen posteriorly. On each side of the latter is a dark area representing the ends of the torn sphincter.

for a week. The bowels may be moved on the third or fourth day, straining being avoided. The patient should be allowed to sit up about the fourteenth day.

(b) *Where there is an Associated Rectocele.*—Colpoperineorrhaphy should be performed (see p. 325).

(c) *Where the Anus is Included in the Laceration.*—A lateral incision is made through the skin on each side, extending from the torn end of the external

sphincter forward on the inner margin of the labium majus for an inch or slightly more. Then another incision is made with sharp-angled scissors into the lower or free edge of the rectovaginal septum. These incisions are then deepened. They result in the formation of four flaps—two anterior or vaginal, and two posterior or anal.

These are held at the corners with artery forceps, while the rectovaginal septum is divided as high as is deemed necessary. The vaginal flaps are then turned forward and the anal backward so that a large quadrilateral

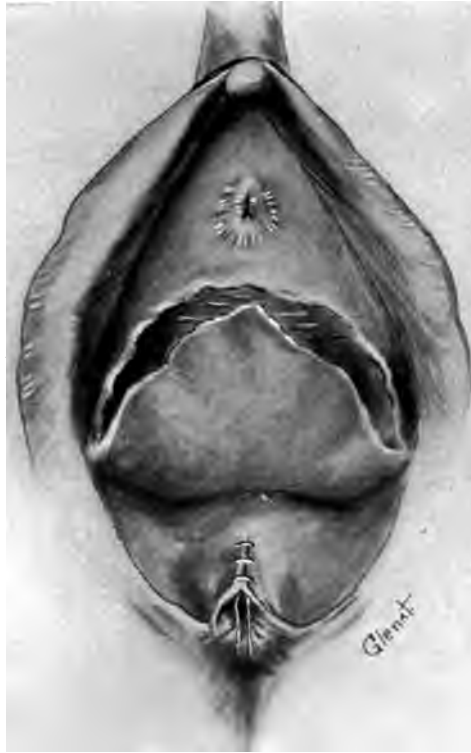


Fig. 154.—Colpoperineorrhaphy by flap-splitting method. The posterior vaginal wall flap is carried forward and the anal flaps are stitched together with chromicized gut.

raw surface is exposed, in the lower angles of which the torn ends of the external sphincter are found.

The anterior or vaginal flaps are next brought together in the middle line by a few catgut sutures tied on the vaginal surface. The posterior or anal flaps are also stitched together in the middle line by several chromicized catgut sutures tied on the mucosal surface. The ends of the retracted torn sphincters are then carefully dissected out and stitched together in front of the united anal flaps, formalin catgut being used. The quadrilateral raw surface is then closed from side to side by a series of interrupted silkworm-gut,

impermeable linen, or silk sutures. At the end of the operation a new perineum exists, the anus has been repaired, and the introitus vaginæ made smaller.

After-treatment.—The patient is fed on liquids, *e. g.*, egg-albumen, plasmon, clear broths, for eight days.

On the eighth day a saline aperient should be given, a mixture of olive-oil (2 oz.) and glycerin (1 oz.) being injected into the rectum carefully before the bowels move. Thereafter every second day a little laxative medicine should be given. The patient lies in bed for about sixteen days ordinarily.



Fig. 155.—Repair of perineal laceration involving the anus. The illustration represents the posterior vaginal wall flap carried forward, the anal flaps closed with sutures, and the separated ends of the torn sphincter stitched together.

If suppuration occurs, so that healing is longer delayed, she must rest for a longer period.

INJURIES TO FASCIA AND MUSCLES OF THE PELVIC FLOOR.

Besides the outward tears produced by labor which I have just described, there are frequently produced solutions of continuity or permanent stretching in the fascial and muscular structures of the floor, especially in the former. I have already stated that this may take place in the perineum without any

external lesion, this structure being left after labor as a thin, weak septum, which may become a factor in the production of downward displacements, just as if there had been a complete laceration. It is, therefore, not difficult to believe that similar results may be produced in other parts of the pelvic floor as a result of the great stretching which takes place in labor. Stratz, Skene, and Kelly have given some attention to this subject, but we are not in possession of very definite information regarding it.



Fig. 156.—Colpoperineorrhaphy by flap-splitting method. Appearance of perineum at end of operation.

DOWNWARD DISPLACEMENT OF THE PELVIC FLOOR.

In studying the various downward displacements of the pelvic floor a thorough knowledge of the structural anatomy of the soft parts is essential to a correct understanding of these conditions. The reader is therefore referred to Chapter I.

The truest idea of the pelvic floor is gained when we consider it as having a strong fascial framework in which are suspended bladder, vagina, uterus, and

rectum, and having in connection with it certain muscular structures which give additional strength. The floor, as a whole, thus resists intra-abdominal pressure, the anterior and posterior parts of the floor being intimately connected by the fascial and muscular tissues.

Prolapse of the bladder and urethra, vagina, and uterus must be considered in relationship to the resistance offered by the fascial and other tissues which suspend them in the pelvis to intra-abdominal pressure. If the tissues



Fig. 157.—Colpoperineorrhaphy as performed by the author in cases of marked perineal laceration with prolapsus. The illustration represents the posterior vaginal wall flap carried forward and a V-shaped mesial portion removed from it.

be weakened or the pressure increased, or both of these factors be combined, prolapse tends to occur.

Varieties.—1. The floor may be prolapsed as a whole (rarely).

2. The anterior vaginal wall and bladder only may prolapse (cystocele).

3. The posterior vaginal wall may alone prolapse.

4. The posterior vaginal wall and anterior rectal wall may together prolapse (rectocele).

5. The uterus alone may be the first to prolapse, dragging after it the parts of the floor attached to it. It must not be forgotten that the uterus has

less strong attachments to the rest of the floor and to the bony wall than either the bladder, vagina, or lower part of the rectum. It has no strong fascial layer attaching it to the pelvis. Its connections are more elastic in nature than those of the other structures mentioned, and they may alone become weakened. Retroversion or retroflexion usually results primarily from this. If the retrodisplacement be partial, so that the uterus lies in line with the long axis of the vagina, the position is favorable to the prolapse. If, however, the fun-



Fig. 158.—Perineum badly repaired after complete rupture in labor. The torn sphincter was not well approximated, resulting in incomplete control of the bowel.

dus be driven further back so that a marked retroflexion is produced, the tendency to prolapse is somewhat diminished (Schultze).

6. In the majority of cases of prolapse there is a descent of the anterior part of the floor, in which the bladder, vagina, and uterus participate. These are the numerous cases which occur in women who have had their pelvic floor damaged during labor, who rise too soon from bed, go to work too soon, and in whom intra-abdominal pressure is increased by coughing, working, tight lacing, etc.

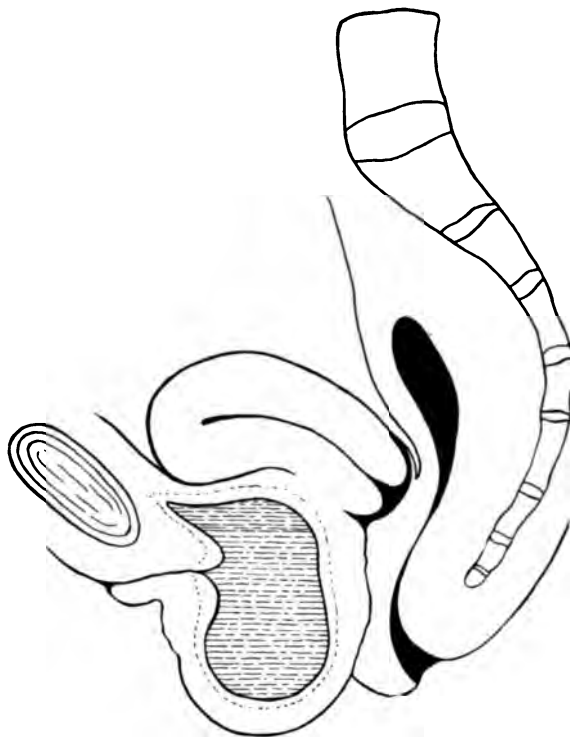


Fig. 159. Cystocele.



Fig. 160.—Rectocele.

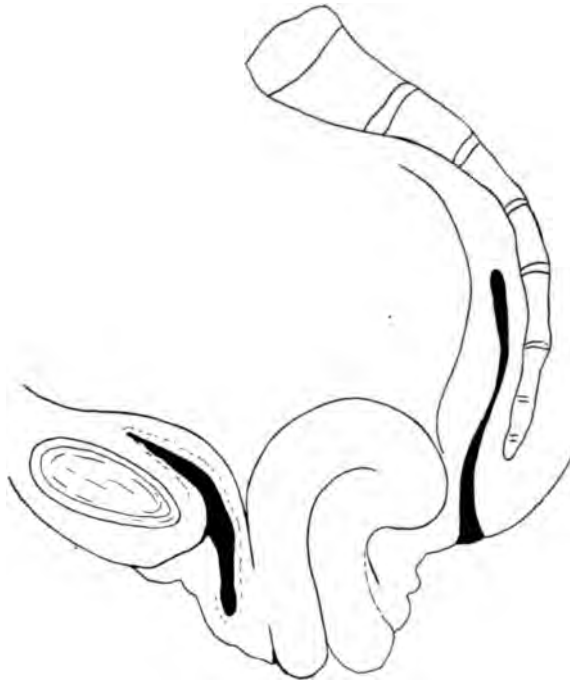


Fig. 161.—Prolapsed and retroflexed uterus.

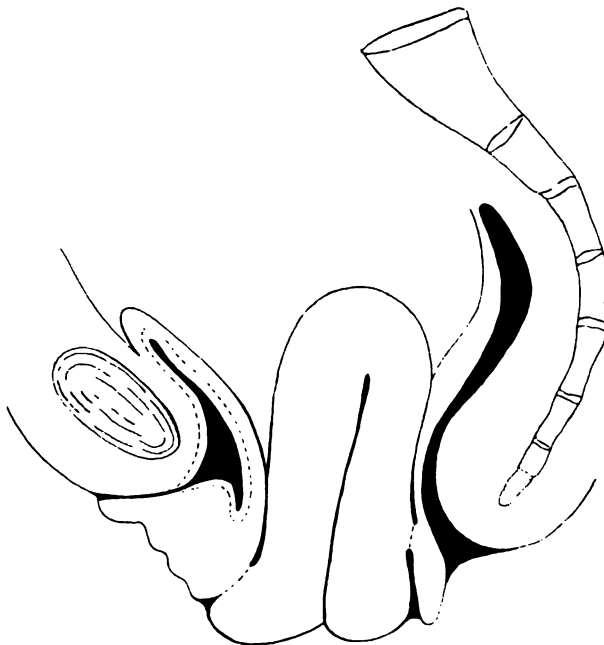


Fig. 162.—Advanced prolapsus uteri.

The condition is, in reality, a hernia of a considerable part of the floor. The question as to whether the uterus drags down the anterior vaginal wall and bladder, or these structures the uterus, or which is the first to be prolapsed, is of secondary importance. In the puerperium the attachments of all these structures are weakened as a result of previous softening, stretching, or tearing; and the uterus is frequently displaced backward during the latter part of this period. Increased intra-abdominal pressure tends to drive down the weakest part of the floor, and the part which is most dependent, *i. e.*, the lower part of the vagina, makes its appearance first beyond the normal pelvic-floor projection in almost every case. This is what one would expect from the study of the puerperal pelvis. My sections show that after labor there is usually some bulging of the lower part of the vagina and bladder. This is also a very common clinical observation. That the lower part of the posterior vaginal wall is the last to appear is to be explained by its firm attachment to the other tissues of the perineum.

PROLAPSUS UTERI (PROCIDENTIA).

These terms are applied to the condition in which the uterus forms a prominent portion of the descending mass, the latter term being usually restricted to the cases in which the uterus projects more or less external to the vulva. Most authors have studied prolapse of the uterus as a disturbance of the uterus itself. Schultze, for example, in his classic work, states that the essential part of the disturbance is a descent of the whole uterus, the direct cause being a relaxation of the uterosacral ligaments, which gives rise to retroversion, a displacement which he believes to be always a preliminary stage of a prolapse. Berry Hart has for several years insisted that this view is wrong, and that the condition is in reality only a hernial protrusion of the pelvic floor, the uterus forming a portion of the covering of the hernia.

From a thorough study of the pelvis in its anatomic and pathologic relationships the author believes that Hart's description of prolapse is correct, though he differs from him regarding the mechanism by which the condition is produced. Variations in its production are noticed.

1. Prolapse in early life is rare, but when it does occur, it is undoubtedly a condition connected with weakening of the floor. In fact, the whole floor may be prolapsed, *e. g.*, as in the case of a child, recorded by Breisky, where bladder, vagina, uterus, perineum, and rectum were prolapsed. Prolapse of the uterus alone in childhood is undoubtedly one of the rarest conditions, though it and the vagina are more favorably placed for descent than in the adult condition, being more vertical in the pelvis.

2. Prolapsus uteri may occur, the uterus remaining anteverted or ante-flexed. Even Schultze admits this, though he says it is rarely met. It may, however, be claimed by some that the anteverted position is brought about in these cases after the prolapse has been completed.

In a normal condition of the floor, with the uterus lying to the front, intra-abdominal pressure only tends to make the organ more decidedly anteverted, thus opposing a tendency to prolapse. Consequently, marked weakening of the floor must take place to permit the uterus to prolapse while remaining anteverted.

3. Most cases of prolapse undoubtedly have the mechanism described by Hart, *i. e.*, the anterior vaginal wall and bladder descend first, the lowest part appearing first, followed by the cervix, and lastly by the posterior vaginal wall, its lowest part appearing last. That this is not the mechanism in all cases is evident from the following considerations:

1. Prolapse may occur more or less rapidly in nulliparæ where the pelvic floor has hitherto been sound and strong, as the result of a fall or of sudden lifting of heavy weights, etc.

2. Cases of traumatic retroversion in nulliparæ have been sometimes found to be followed by prolapse of the uterus.

3. In some cases of chronic prolapse the anterior vaginal wall does not descend first, but the uterus, dragging after it the vaginal walls.

4. Cases of cystocele are not necessarily accompanied by prolapse of the uterus.

The only satisfactory manner in which these differences can be explained is by admitting that there are various kinds of prolapse in the pelvic floor.

Prolapse may be acute, subacute, or chronic; the last is by far the most common variety, and is the form ordinarily referred to under this term. It is extremely rare in women who have never been pregnant. It is rare in women who are in good circumstances and lead a comfortable life, even though they are multiparæ. It is common among poor, hard-working women.



Fig. 163.—Procidentia. The uterus is almost entirely external to the vulva.

The influence of pregnancy and labor on the floor is as follows: its tissues are softened and stretched by the increased intra-abdominal pressure, as well as during the birth of the child, when it may also be torn. After labor, the floor bulges down more because of this stretching. Among the poor, women usually rise too soon from bed and begin too early to do such work as lifting, carrying, etc. Hence the greater tendency to a prolapse of the floor among them.

What part does the perineum play? There is no doubt that it is usually

found to be more or less ruptured. Thomas, who described the perineal body as a wedge supporting the anterior part of the floor, said that the destruction of the wedge resulted in the prolapse. This is no longer believed. That rupture of the perineum favors prolapse when other causes are in operation is undoubtedly true. It does so, however, not because a supporting wedge is removed, nor because a supporting segment of the floor is weakened. These mechanic explanations are not in keeping with the anatomy of the floor. Neither is it, as is so often said, because the junction of the levatores ani is torn through. In an ordinary mesial tear, passing even into the anus, only a small part of the pubococcygeus can be torn, namely, those fibers which are deflected inward to the perineum from the main mass of the muscle which passes back on each side of the middle line to the coccyx. The most important structures divided are the various fascial tissues which meet in the perineum—a point which has been generally overlooked.

These are the following: 1. Triangular ligament—anterior and posterior layers. 2. Recto-vaginal visceral layer. 3. Anal fascia. 4. Deep superficial fascia.

It is evident that such a rupture must lead to a weakening of the suspensory framework of the floor, especially in its anterior half.

The tearing of the small muscles, *e. g.*, transversus perinei profundus, transversus

perinei, sphincter vaginae, and sphincter ani, gives them afterward but a small share in the support of the floor, though their loss is of minor importance when compared with that of the fascial structures.

In many women, chiefly among the well-to-do, who undergo little physical exertion, these losses may be present for a long time and yet no prolapse occur. This is because the rest of the suspensory framework is sufficient to resist the normal intra-abdominal pressure. If, however, conditions are present which cause an increase in intra-abdominal pressure, *e. g.*, bronchitis, the result may be that a prolapse occurs because the intra-abdominal pressure is too strong for the weakened floor. It is well known that there may be congenital deficiency of the perineum without prolapse. One interesting case is recorded by Prochownik, in which a girl lived in this condition until she was nearly twenty. She then, however, was put to very hard physical exertion for several months, and the result was a prolapse.



Fig. 164.—Procidentia. There is extreme ulceration of the cervix uteri near the os externum, and posterior to the latter is a carcinomatous growth.

Summary of the factors concerned in the production of prolapse:

1. Rupture of the structural framework of the pelvic floor.
2. Weakness in parts of the floor. Though actual rupture may not have occurred, permanent weakness may be induced by the great stretching of parts and may affect fascial structures, muscle, and cellular tissues. In the great majority of cases the stretching is caused by labor.
3. Increase in the intra-abdominal pressure. This may abnormally



Fig. 165.—Procidentia. An ulcerated area is seen on the right side of the everted vagina. The mass is pushed from the pelvis by the accumulation of a large quantity of fluid in the abdomen due to malignant disease.

affect the pelvic floor. It is due to various causes. Enteroptosis in its various forms, especially when associated with marked separation of the recti abdominis muscles. Chronic coughing may lead to it; also tumors or ascites in the abdomen; too tight constriction of the body by the clothing; extra muscular efforts, *e. g.*, lifting, carrying; habitual overdistention of bladder and bowel. In faults of the bony pelvis, as A. R. Simpson points out, in which the brim becomes more or less parallel to the horizon, downward dis-

placement of the uterus is favored, the intra-abdominal pressure acting more directly on the floor.

Complications Associated with Prolapse.—The uterus usually becomes hypertrophied.

The whole organ may be enlarged, or the cervix especially may become elongated. Endometritis or endocervicitis is often present.

The vaginal wall in cases of procidentia loses its rugosities, thickens, and



Fig. 166.—Prolapse; dissection to show relationship of ureter (Tandler and Halban).

becomes skin-like. It may become infected or ulcerated. When the bladder is prolapsed below the level of the urethra cystitis may develop in the diverticulum thus formed; calculus formation may occur.

The rectum may be irritated, especially if a rectocele form, and defecation may be incomplete. Ordinarily there is no rectocele, the posterior vaginal wall having separated from the gut. Prolapse of the rectum through the anus is rarely found.

The appendages are dragged downward. Peritonitis may occur, forming adhesions in the hernial sac and among the viscera, rendering it dangerous to attempt reposition. Barbour Simpson has recently reported a case of irreducible procidentia which ended fatally. There was extensive peritonitis,



Fig. 167.—Vertical mesial section of pelvic viscera removed from a case of fatal irreducible procidentia (right half of tumor): 1, Fundus uteri; 2, lower end of cervical canal with everted thickened lips; 3, hypertrophied vaginal wall; 4, uterovesical pouch with flaky deposits of lymph; 5, pouch of Douglas; 6, wall of bladder; 7, urethra seen to the left, displaced upward; 8, anal canal; 9, inflammatory mass in mesentery; 10, collection of pus among coils of small intestine in direct communication with 4; the upper limit is seen about three-fourths of an inch higher (Barbour Simpson).

a collection of pus being present among coils of small intestine and communicating with the uterovesical pouch.

Physical Signs in Prolapsus Uteri.—It is evident that many different conditions may be found, varying according to the degree of the prolapse.

If the condition be partial, the lower part of the anterior vaginal wall bulges downward when the patient is in the erect position, when she coughs or presses down; the cervix is lower than normal, and this may cause the posterior fornix to appear abnormally deep. The uterus is enlarged and lies with its long axis in line with the vagina. If the prolapse be complete, the true hernial nature of the affection is readily understood, the sac of the hernia being the peritoneum; its boundaries, the pubes, anterior rectal wall, obturator internus, and levator ani muscles; its coverings, bladder, anterior and posterior vaginal walls,

and uterus; in the hernial sac are intestines. The parts may be considerably below the level of the pelvic-floor projection. After replacement they may be prolapsed when the patient rises, when she coughs or bears down. The uterus may be considerably enlarged; the vaginal walls over it may be much hypertrophied, ulcerated, or excoriated. A catheter or

sound passed into the bladder distinguishes the prolapsed portion. If there is a rectocele, it may be distinguished by introducing a finger through the anus.

Symptoms of Prolapsus Uteri.—The patient has a feeling of dragging or weight in the loins or pelvis. When the uterus is outside, or partially outside, she feels discomfort. There may be difficulty in micturition or frequency. Symptoms of cystitis and of stone may develop, Diarrhea or difficulty in defecating may exist. Menorrhagia is often present, due to the associated endometritis. Leukorrhea may arise from the same cause, from endocervicitis, or from inflammation or ulceration of the vaginal walls. As a rule, there is sterility, but conception may occur, and there may be much discomfort in the early months of pregnancy.

Differential Diagnosis.—The condition must be diagnosed from hypertrophic elongation of the cervix, cystocele, rectocele, inversion of the uterus, uterine tumors with or without inversion, swellings of the pudenda.

Prognosis.—When once a prolapse is established, there is no tendency to spontaneous recovery. It may be modified by pregnancy. During the first three months the uterus tends to sink down more markedly, and abortion may occur. If the womb is supported during this period until it has begun to rise above the brim, there is usually no trouble during the rest of pregnancy. After delivery the prolapse is usually found to be increased. The condition may be also modified by the menopause. The parts undergo some degree of atrophy, and there may be some relief in symptoms. Often, however, the prolapse becomes more marked.

Diagnosis of Cystocele.—There is a pouching downward of the anterior vaginal wall and bladder, the uterus and posterior vaginal wall being normal or somewhat prolapsed. It is more evident when the patient coughs or strains. She may complain of something falling down, or may feel discomfort. Frequency of micturition is a common symptom.

Diagnosis of Rectocele.—The lower part of the anterior rectal wall bulges forward with the posterior vaginal wall. This is especially apt to occur if there be a marked tear of the perineum. The uterus and anterior

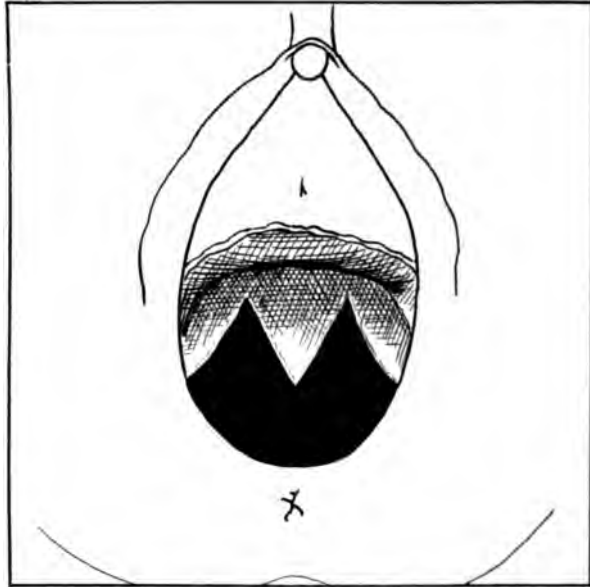


Fig. 168.—Diagram showing raw surface made in Emmet's colpoperineorrhaphy.

vaginal wall are in position; sometimes these may also be prolapsed. The finger passed into the rectum enters the pouch. Fecal matter tends to collect in the latter.

Diagnosis of Vaginal Enterocoele.—Anterior or posterior enterocoele may occur. In the first mentioned, the intestines are forced downward between the upper part of the vaginal wall and the bladder, bulging the former into the vaginal canal. On passing the sound the bladder is found to be in position, or perhaps pushed somewhat forward. In the last mentioned, the intestines descend between the rectum and vaginal wall, and bulge the latter into the vaginal canal. Posterior enterocoele is distinguished from rectocoele by passing the finger through the anus, the characteristic pouching of the latter being found absent.

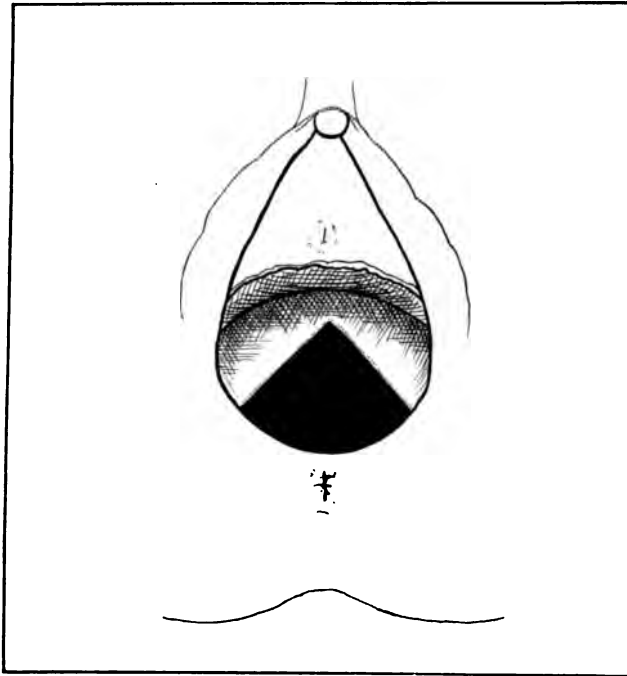


Fig. 169.—Diagram showing raw surface made in Hegar's colpoperineorrhaphy.

Treatment.—Prophylaxis is important. Labors should be carefully conducted. Ruptures should be repaired at the time of labor or at the earliest possible time afterward. The patient should not be allowed to rise too soon nor to work too early. Actual treatment is carried out on the following lines:

The pelvis should be carefully examined in order to determine the extent and character of the lesion. Replacement of the prolapsed parts should then be carried out.

In some cases of procidentia the latter may be so congested and edematous that it is necessary to put the patient at rest for a few days. Sometimes, a

tumor or other intrapelvic complication may prevent replacement. Where there is peritonitis, it may be dangerous to manipulate the tissues; in such a condition antiphlogistic measures should be carried out, and, later, efforts should be made to replace the parts slowly and cautiously. When reduction is effected, the following measures may be employed to prevent a recurrence of the prolapse:

Treatment by Pessaries.—For a long period mechanic appliances have been used to retain the parts in position. In moderate degrees of prolapse, various forms of pessaries may be placed in the vagina. When there is a cystocele or an anterior enterocele, one of the following may be used, viz., a ring, a diaphragm ring, a Hodge pessary with transverse bars, a round or oval-shaped pessary. Where there has been an extensive rupture of the perineum, it is found, as a rule, that only the ring instrument can be retained in position.

Similar pessaries may be used when there is a rectocele or a posterior enterocele.

In slight degrees of prolapse of the uterus associated with retroversion a Hodge pessary should be tried. In more marked cases a Hodge pessary may sometimes act satisfactorily, but usually a ring, ball, or Zwanck instrument is necessary, the choice of an instrument depending largely upon the state of the perineum.

When a patient is suitably fitted, there may be much satisfaction, *i. e.*, her symptoms may be relieved and the descent of the parts prevented. When the perineum is badly torn, a pessary can rarely be retained.

In extreme cases, especially of old standing, no pessary will remain in the vagina unless it be held by bands. In these cases operative treatment is imperative. Where the patient will not submit to this method, a cup pessary, attached to an abdominal belt, or a T-bandage may be employed. Sometimes women prefer periodic packing of the vagina with gauze or oakum; this method should never be employed before the menopause has been passed.

In recent years the employment of pessaries in the treatment of prolapsed conditions has to a great extent been superseded by operative measures. The former method is usually only palliative, rarely curative; whereas surgical repair measures are capable of establishing permanent benefit by shortening

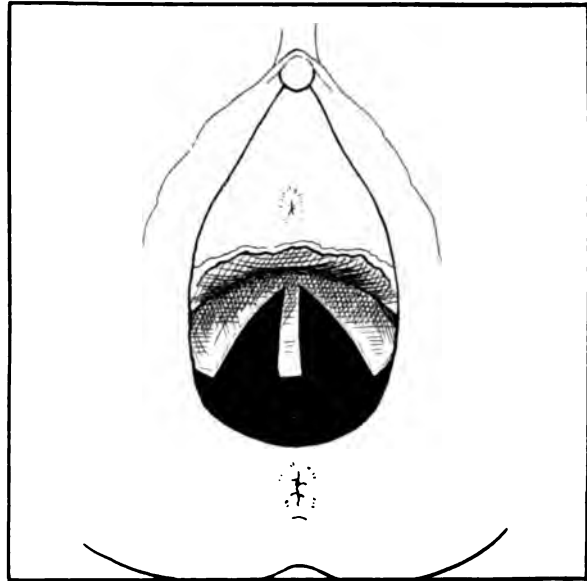


Fig. 170.—Diagram showing raw surface made in Martin's colpoperineorrhaphy.

and strengthening the stretched tissues, restoring continuity of those which have been torn, or by removing redundant and unnecessary structures.

Operative Treatment.—*Anterior Enterocoele.*—In this rare condition, in which there is a descent of the intestines between the bladder and cervix, forming a downward pouching of the anterior vaginal wall, a T-shaped colpotomy incision should be made in the anterior fornix. The peritoneum should then be pushed upward and the posterior part of the bladder stitched with catgut to the anterior surface of the cervix. An oval flap of the anterior vaginal wall which covered the enterocoele should then be removed, and the edges of the raw area closed with a continuous catgut suture.

Posterior Enterocoele.—When the intestines descend between the vagina and rectum, bulging the posterior wall of the former forward, the following

procedure may be employed if the condition be not extensive:

A vertical mesial incision should be made in the posterior vaginal wall, the peritoneum should be stripped upward as high as possible, and the anterior wall of the anus should be stitched to the vaginal wall, after a portion of the latter has been cut away parallel with the incision. In this way a new rectovaginal septum is formed.

Where the condition is extensive, a portion of the stretched posterior vaginal wall should be removed as an oval flap and the edges closed with chro-

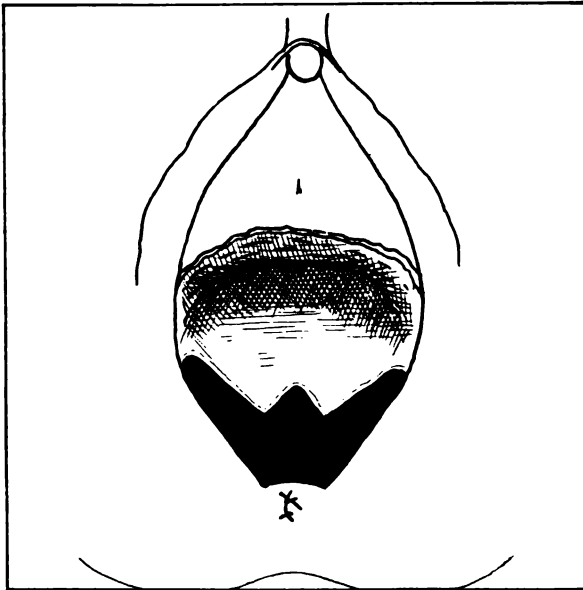


Fig. 171.—Diagram showing raw surface made in Kelly's colpoperineorrhaphy.

micized gut. The abdomen should then be opened, the patient being placed in the Trendelenburg posture, and the lower part of the pouch of Douglas should be obliterated by the suture of the rectum to the posterior vaginal wall. Sometimes this entire procedure may be carried out through the abdominal incision.

Cystocoele.—When there is a descent of the bladder and anterior vaginal wall, anterior colporrhaphy is performed as follows:

The patient is placed in the lithotomy position and the cervix is pulled downward and backward and the anterior vaginal wall, grasped with a volsella above the urethral orifice, is drawn upward. An oval incision is made through the vaginal mucosa as large as is required, the long diameter being in the long axis of the vagina, the size varying according to the degree of prolapse.

A vertical incision is made from end to end of the oval through the mucosa, and each lateral flap of mucosa is dissected off until the oval raw surface is left. This is then closed from side to side by a continuous formalin catgut suture, passed in stages, care being taken not to injure the ureters, which may be near the upper part of the raw surface. The edges of the vaginal mucosa are approximated with continuous chromicized gut. As cystocele is frequently associated with descent of other parts and with laceration of the perineum, various other operative procedures may be combined with anterior colporrhaphy.

Rectocele.—In this condition many operators carry out a procedure somewhat similar to an anterior colporrhaphy, a flap of vaginal mucosa being removed over the projecting swelling, the raw area being closed from side to side.

In the great majority of instances the perineum is torn and relaxed, and it is more common to remove the flap from the anterior portion of the perineum, as well as from the vaginal wall. Various patterns of flaps have been recommended, some of which are represented in the preceding figures.

The operation is ordinarily carried out as follows: An anterior spatular speculum is introduced to pull up the anterior vaginal wall. The vulva is widened by means of retractors. The middle of the posterior wall of the vagina, about one and one-half inches above the perineum, is held with a volsella. Below this, on each side, the lateral edges of the same wall are held with forceps. In this way the lower part of the posterior wall is put on the stretch. Then, with knife or scissors, an incision is made on the posterior vaginal wall and perineum, according to the pattern selected. The flap is then dissected off and the raw surface closed from side to side. The vaginal portion should be closed before the perineal part is stretched.

The author has abandoned this method of operating and has adopted one which allows the raw area to be made with greater ease. It is somewhat similar to the flap-splitting operation for repair of the perineum.

A horseshoe incision is made through the skin at the anterior margin of the perineum and lateral wall of the introitus. With scissors the incision is deepened so as to free the vaginal wall posteriorly from the tissues of the perineum, and from the rectum as far up as may be considered advisable. Great care must be taken to keep close to the vaginal mucosa, in order that the rectum may not be injured.

The edge of the flap is then grasped on each side with forceps, which are held by an assistant. A triangular portion of the flap is then removed, the apex reaching to the upper level of the rectocele.

Either of the following methods of closure of the raw area may then be employed:

1. A continuous formalin catgut suture is used to close the raw surface in stages from side to side, a continuous chromicized suture being used to approximate the edges of the vaginal mucosa and skin.
2. The vaginal mucosa at the apex of the raw area is raised with forceps so as to form an angle on each side in the edges of the incised vaginal mucosa. The sides of each lateral angle are then approximated with chromicized catgut.

The large area of raw surface is closed in stages from side to side by

means of a continuous formalin gut suture. The remaining edges of the vaginal mucosa and skin are then approximated from side to side with chromicized gut suture. Instead of closing the raw surface with buried catgut, interrupted silkworm-gut sutures may be passed through all the tissues. The former procedure gives a more nearly perfect closure, but it should be employed only where the technic is thoroughly aseptic.

Prolapsus Uteri.—The operative treatment of this condition varies according to its extent and the complications which are present.

(a) In cases in which there is little or no descent of the vaginal walls or marked tearing of the perineum: The uterine cavity should be cureted. If the cervix is much altered by inflammation or the uterus much enlarged, amputation of the cervix should be performed. Shortening of the round ligaments may then be carried out by Alexander's method, if there be no complicating intrapelvic pathologic conditions requiring attention; or, if the latter exist, by the author's method (see p. 486).

(b) When ruptured perineum, cystocele, and rectocele also exist: In marked cases of this kind curetage, amputation of the cervix, anterior colporrhaphy, posterior colpoperineorrhaphy should be first of all carried out, followed at the same time, if the patient's condition be good, by one of the round ligament operations above mentioned.

If it be thought inadvisable to prolong the anesthesia, the latter procedure may be deferred a week or a fortnight.

(c) When the prolapsed portion forms a prominent swelling external to the vulva: In women who have not reached the menopause, this extreme degree of procidentia may be treated in the manner just described, the only difference being that larger raw areas are made in carrying out anterior colporrhaphy and posterior colpoperineorrhaphy.

In women who have passed the climacteric, I always prefer to carry out the following procedures: Vaginal extirpation of the uterus and adnexa is first carried out according to the method described elsewhere. After extirpation is completed, a vertical strip of the upper part of the vaginal mucosa is removed on each side, and the broad ligaments drawn down, each one being stitched firmly into the raw surface in the lateral fornix. The opening into the peritoneal cavity is then closed. Anterior colporrhaphy and posterior colpoperineorrhaphy are then carried out. This operation is very satisfactory. The broad ligaments, by their new insertion into the vagina, act as a support to the pelvic floor. In postmenopausal cases in which repair of the abdominal wall is advisable owing to separation of the recti abdominis muscles, an equally good result may be obtained if the following procedures be carried out: Curetage, amputation of the cervix, anterior colporrhaphy, posterior colpoperineorrhaphy, ventrofixation. The fundus of the uterus should be firmly stitched to the abdominal wall nearly an inch above the pubes.

After-treatment.—It is practically the same as that described in connection with repair of the perineum and abdominal operation.

Freund recommends the following operation in postmenopausal procidentia: A raw oval surface is made on the anterior and posterior vaginal walls. A transverse incision is then made into the pouch of Douglas, through which the fundus of the uterus is pulled into the vagina. The raw surfaces are then stitched to the uterus and an opening is made in the fundus to

allow discharges to escape. A perineorrhaphy is then carried out. Wertheim performs a somewhat similar operation. The uterus is drawn down through an opening made in the anterior fornix, and is stitched to a raw area made in the anterior vaginal wall. Fritsch stitches the uterus to the posterior vaginal wall.

P. Müller advises the operation of colpectomy performed as follows: The uterus is first cureteted and swabbed out with strong phenol. The cervix is drawn down and the vagina unfolded. The mucosa of the latter is divided half an inch from the recess between the vagina and labia minora and stripped off. If the cervix is hypertrophied, it is amputated. The vagina is then closed. Koenig, who advocates this procedure, reports no trouble from after-accumulation in the uterine cavity.

CHAPTER X.

AFFECTIONS OF THE VULVA.

MALFORMATIONS.

Double Vulva.—This is a rare condition. There may be, as in the case of Katherine Kaufmann, reported by Suppinger, a double vulva, each with a clitoris, hymen, urethra, and anus. Here there were also a bladder and a unicornate uterus, with an ovary and tube in each half of the pelvis.

Infantile Vulva.—In the adult this condition may be found. It may be associated with defective development of the internal genitals; also with diseased states, *e. g.*, chlorosis.

Malformations of Clitoris and Labia.—The clitoris may be absent. It may be bifid; this may be found in epispadias, in which condition, also, there may be complete absence. The organ may be small or abnormally large.

Congenital hypertrophy is often associated with other malformations. The acquired condition is usually due to masturbation. Erotomania is sometimes associated with enlargement of the clitoris, but in many cases it is independent of it and continues if the clitoris be removed. It is always advisable to perform clitoridectomy where there is pronounced hypertrophy.

The prepuce of the clitoris may alone be redundant, a condition which may give rise to irritation and secondarily to masturbation in childhood. In such cases circumcision should be performed. Afterward, the child should be carefully watched and guided, in order that the habit of rubbing the genitalia should be broken. Occasionally, a prepuce is adherent to the clitoris and may be a source of irritation. In such cases the adhesions may usually be divided with a probe. Sometimes it is necessary as well to divide the prepuce by a dorsal mesial incision. When the adhesions are broken, the incision is closed at right angles to its original direction.

The labia majora may be wanting; this condition is usually found with extroversion of the bladder. They may be adherent. The nymphæ may also be glued together. They may be absent in epispadias. There may be sometimes two or three on one side, or they may be hypertrophied.*

Atresia or Defectus Vulvæ.—Rarely a fetus is found in which the genital furrow has not formed, nor any division of the genital tubercle. The rectum, genital canal, and bladder may be in communication, or the rectum may end blindly and be distinct from the bladder. Sometimes there is an anus. There is usually no vagina and no urethra. In such cases the bladder and genital canal are usually greatly distended with urine.

The condition is generally found in nonviable fetuses, *e. g.*, acephalic and symphyliac types.

* Robert L. Dickinson has given an exhaustive account of the peculiarities in the structure of the labia minora in "American Gynecology," September, 1902.

In some cases the atresia is only superficial, being due to the blending of the labia majora or minora; usually it is incomplete, a small opening being found near the clitoris through which menstrual blood can escape. The condition is probably due to an adhesive vulvitis.

Persistence of a Cloaca.—Sometimes the perineal septum is not developed, the urogenital sinus remaining open and communicating with the rectum. There may not be any sphincter muscle at the anus. When there is incontinence, operative interference should be carried out before maturity is reached, for the purpose of making an anal opening. Buckmaster has suggested a procedure which aims at making fibers of the levator ani muscle serve as an anal sphincter.

Hypospadias.—This is found in two forms. In one the perineum has fully developed, but the urogenital sinus has retained its embryonic condition (persistent urogenital sinus). The vestibular canal is long, the urethra and vagina opening into it high up.

In the other form the urogenital sinus has disappeared; there is no urethra, the bladder and vagina opening into the vestibular canal. Here the lower part of the allantois, instead of forming a urethra, has simply given origin to the bladder. On examining the case, the opening of the bladder is seen on the anterior vaginal wall. As a result of this condition there is continual incontinence of urine.

In these cases operative measures should be employed to build up a complete urethra. The adjoining vaginal wall or labia minora may be utilized in the formation of the urethra. E. C. Dudley insists upon the following points: In operating a small sound should be kept in the urethra; if a large one be used, the canal may be too wide afterward. Broad areas of denudation should be made on each side, so as to form a thick urethrovaginal wall, for this usually tends to become thinner. At the end of operation a drainage catheter should be passed into the bladder and retained for a week in order that the new urethra may not be used.

HERMAPHRODITISM.

The term hermaphroditism has been used to describe the condition in which fundamental or secondary male and female characteristics are present in an individual. In the human subject it is of very infrequent occurrence. The varieties may be classified as follows:

I. Pseudohermaphroditism.

1. Partial.

(a) Gynandrous.

(b) Androgynous.

2. Proper.

II. True hermaphroditism.

1. **Pseudohermaphroditism.**—The essential feature of this condition is a peculiarity in development of the genitalia whereby a resemblance to the opposite sex is produced.

1. **Partial.**—(a) *Gynandrous.*—A female may have such a formation of the external genitalia as to bear some resemblance to a male. Various forms occur. The clitoris may be much hypertrophied, so as to resemble a penis.

The labia minora or majora may be fused together so as to resemble a scrotum. Sometimes there is a hernia of one or both ovaries into the labia, making the resemblance to the male more striking.

In some of these cases the face may be hairy and the voice, breasts, and contour of body may be masculine. The uterus and ovaries are usually more or less developed.

In another class of cases facial hairs, small breasts, quality of voice, and contour of body may suggest the male, the external genitalia being very poorly developed.

(b) *Androgynous*.—A male may resemble a female in various par-



Fig. 172.—Pseudohermaphroditism. External genital's of a male, resembling considerably those of a female. The penis was rudimentary, and a small vagina was present. The testicles are not descended.

ticulars. The breasts and bodily contour may be female in type, the external genitalia being masculine, though poorly developed. In another class of cases one or both testicles may be partially descended or entirely undescended. The penis is small, and there is a median depression in the scrotum simulating the apposed labia majora of the female. There may also be small projections of skin along the scrotal depression, suggesting the labia minora.

2. **Pseudohermaphroditism (properly so called)**.—The majority of cases occurring in human beings fall under this heading.

The condition is that of imperfect development in the male, whereby perineoscrotal hypospadias or persistence of the urogenital sinus is produced.

The penis is small, and may be curved and closely fastened to the pubes, a well-marked frenum being present under it. The glans is imperforate, and may be small or large; at its extremity is a depression continuous with a furrowed band extending to the meatus urinarius, corresponding to the median raphé in the female vestibule. The prepuce simulates the arrangement in the female.

Underneath is a rudimentary vulvar orifice, usually scarcely admitting a finger-tip. There may be a hymen, portions of the Müllerian tract, *e. g.*, vagina, uterus, Fallopian tubes. There may be small labia. The testicles are usually rudimentary, and may be partially or completely descended or



Fig. 173.—Pseudohermaphroditism. Photograph of patient represented in Fig. 172, with descended testicles.

entirely abdominal. The breasts, buttocks, and thighs may be female in character. There is little projection of the larynx, and the voice may be feminine. The beard is usually scanty, but may be well developed.

Such cases at birth are generally regarded as females. In adult life many have married as females and coitus has often taken place by gradual dilation of the urinary orifice. Often, however, the sexual desire is strongly inclined toward females, and coitus may be performed imperfectly. There may be a simulation of menstruation, hemorrhages occurring as the result of irritation of the dilated urethra or vagina (prostatic vesicle).

II. True Hermaphroditism.—This term applies to cases in which ovarian and testicular structures are present in the same individual. Though

the occasional occurrence of this condition has long been undoubted, much skepticism has been expressed by various authorities in recent years. Nagel, for example, states that it probably cannot exist, and holds that the ovary is never found with the testes in cases of so-called hermaphroditism. Recently, however, Sarré has described the case of an individual with the external configuration of a woman, who possessed a well-developed imperforate penis. On making a rectal examination two small bodies, each the size of a pigeon's egg, could be felt in the left half of the pelvis, while in the right inguinal canal an ovoid body was found. An exploratory incision was made over the latter and the swelling removed, along with a smaller mass attached to it. Micro-



Fig. 174.—Pseudohermaphroditism. Patient represented in Fig. 172. The halves of the scrotum (labia) are separated, and the penis elevated, showing the small vagina posteriorly.

scopic examination proved these to be testicular structure and epididymis. Another small mass near the testicle was also examined and found to be ovarian tissue. A fallopian tube and a structure resembling the vas deferens were also present. Sarré believes that, with the exception of another case described by Ziegler, all other records of true human hermaphroditism are very doubtful, though he thinks it has been clearly demonstrated in some lower mammals, *e. g.*, the pig.

Ballantyne holds that there has been no conclusive proof of bilateral hermaphroditism (the existence of ovary and testicle on both sides of the body), but states that unilateral hermaphroditism (ovary *or* testis on one side and

ovary *and* testis on the other) is undoubted, and he refers to a specimen of his own and to one described by Blacker and Lawrence.

There is another condition in the male, namely, epispadias, in which the urethra and bladder are open anteriorly, which might possibly be mistaken for pseudohermaphroditism, but the nature of the case is evident from the presence of scrotum, testicles, and normal perineum.

Treatment of Hermaphroditism.—When the condition is discovered in childhood, the true sex should be ascertained, if possible, in order that the



Fig. 175.—Pseudohermaphroditism. Appearance of perineum of patient represented in Fig. 172 after plastic procedures had been carried out. The vagina was obliterated, the halves of the scrotum united, and a projecting penis $1\frac{1}{2}$ inches in length was obtained. A urethral extension, nearly five inches in length, was made, its outer end being placed in the tip of the penis. The individual was thereafter able to urinate in the erect posture, and the penis was capable of erection under sexual excitement.

individual may be educated accordingly. In doubtful cases it is advisable to consider the sex male. After puberty, the true character may be established.

Operative measures may be employed in certain cases. Thus a hypertrophied clitoris or labia may be removed. Adherent labia may be divided.

In the case of perineoscrotal hypospadias, interesting plastic work may be carried out in some cases with very satisfactory results. In Figs. 172-175 are seen the results of a series of operations performed by the author in the Presbyterian Hospital, Chicago. The frenum holding the penis was divided,

and the perineoscrotal fissure covered, so as to form a new urethra to the extent of five inches. The latter was carried to the tip of the penis, so that urination was afterward possible in the manner of the male.

INFLAMMATION OF THE VULVA (VULVITIS).

Owing to the skin-like character of the covering of that portion of the genitalia known as the vulva, inflammatory changes in the latter correspond more or less to those which occur in the general cutaneous surface of the body. Because of the peculiar situation of the vulva, it is of a less resistant nature than the general skin.

The vulvar epidermis is usually moister than that of the skin elsewhere, and is consequently softer. This is most marked in women of unclean habits, or in those troubled with excessive discharges of a pathologic nature. The latter may often exercise a chemic action as well on the cells.

The hair of the vulva is apt to lead to the accumulation of dirt of various kinds. In childhood, in advanced age, in debilitated conditions, in pregnancy, and in the puerperium the epidermis is more liable to injury and inflammation. Many varieties of pathogenic and saprophytic micro-organisms are found on the vulva, the latter being most numerous. Menge states that cultures of pathogenic germs are less frequently obtainable from the vestibule than from the outer part of the vulva, and believes that this is because the same germicidal influence which is found in the vagina exists in the vestibule, though to a less extent. Certain of the specific organisms associated with distinct morbid processes may also be found, *e. g.*, the tubercle bacillus in tuberculous lesions, the diphtheria bacillus in diphtheric patches, leptothrix and oïdium in the vulvitis of diabetes, and the gonococcus in gonorrheal inflammation.

Etiology.—The factors which are concerned in the production of vulvar inflammation are, in general, those already mentioned above. Of these, the most important are micro-organisms. Indeed, they are probably the essential cause in all cases, the mechanic and nutritional disturbances acting usually as favoring conditions. In detail, the various factors may be stated as follows:

1. All forms of venereal infection, the active agent being, probably, micro-organisms. Of these, the most common is gonorrhea; it is, indeed, the cause of vulvitis in the majority of cases.
2. Various well-determined organisms, *e. g.*, those of diphtheria, tuberculosis, leptothrix, oïdium.
3. Various pathogenic and saprophytic germs.
4. Discharges which soften or exert a chemic action on the epidermis, *e. g.*, urine from a vesicovaginal fistula, fecal matter from a rectovaginal fistula, discharge from a malignant growth, diabetic urine, etc.
5. Local irritation, *e. g.*, masturbation, scratching, ill-fitting pessaries, awkward coitus, rape, friction of the labia in fat women of dirty habits, worms, insects, etc.
6. General conditions which lessen the resisting power of the epidermis, *e. g.*, childhood, old age, pregnancy, puerperium, exhausting diseases, *e. g.*, tuberculosis, the eruptive fevers.

Pathology.—Vulvitis may be acute, subacute, or chronic. It may start on the outer surface or on the parts in apposition, and may begin in the hair-follicles, the sweat-glands, the sebaceous glands, Skene's glands, the ducts from the Bartholinian glands, the meatus urinarius.

The *catarrhal* variety is most common, especially in an acute form. The epidermis is red, swollen, and bathed in a mucopurulent discharge. The orifice of each Bartholinian duct may be surrounded by a red areola, and from it pus may be squeezed. The glands themselves may be swollen and may become distended with pus. Marked edema is often present when the affection occurs in pregnant and puerperal cases. In chronic cases excoriation of the epidermis or ulceration may develop. These may be made to bleed easily. Lymphangitis and inflammation of the inguinal glands are frequent, especially in acute vulvitis, the enlarged, infected gland being termed a "bubo."

In infancy adhesion of the labia majora and labia minora may result from vulvitis. This may be so extensive as to close almost the entire vulvar slit; in such a condition a small opening may be left, either near the anterior or posterior commissure, through which the urine escapes. There may, however, be such interference with the passage of this fluid that much irritation and distress may be caused, especially when the opening remains anteriorly.

In some cases the follicular type may be most prominent, hair-follicles, sweat- and sebaceous glands being chiefly affected. Small, acne-like swellings are formed, in which pus is often present. The follicles may burst, or may continue as small, hard nodules.

Sometimes the inflammation may extend to the connective tissue under the epidermis, forming thick, phlegmonous areas. Suppuration may take place and form deep abscesses, which may burrow in various directions and lead to extensive sloughing. In some forms, especially in children suffering from typhus, scarlatina, or measles, gangrene may occur.

In *diphtheric* vulvitis a characteristic, superficial gray membrane develops. The same condition may result from the action of bacteria other than the diphtheria bacillus, especially streptococcus, in certain cases of puerperal infection.

Symptoms.—There is a free discharge, together with tenderness or pain in the region of the vulva, aggravated on walking, on micturition, and on coitus. When very acute, febrile symptoms may be produced, especially if the inguinal glands are infected. In most cases the patient usually becomes depressed in health, loses appetite, and various nervous disturbances may develop.

Treatment.—In acute cases the patient should be kept quiet, rest in bed being advisable. The vulva must be continually cleansed. Shaving of the hairs is advisable as a preliminary measure. Gauze dressings soaked in antiseptic solutions should be applied. Of all the solutions employed, the author has had most success with a glycerinated, watery solution of formalin (formalin, 10–25 drops; glycerin, 6 oz.; water, 14 oz.). The pads soaked in this solution may be applied every few hours, being covered externally with a sheet of waterproof material. Lysol, salts of mercury, and other antiseptics are also employed.

Sometimes the local distress is so great as to necessitate the use of soothing

applications. A boric starch poultice or lead and opium lotion is very satisfactory for this purpose. Hot sitz-baths, especially those containing sodium bicarbonate and bran, are also valuable.

After the acute stage has subsided, if healing does not rapidly take place, a solution of silver nitrate (10-15 gr. to 1 oz.) may be applied to the affected parts every three or four days, the labia being separated by gauze powdered with oxid of zinc, subnitrate of bismuth, or a mixture of magnesium carbonate, talc, and lycopodium.

In mild cases irrigation with a solution of formalin (15 or 20 min. to a pint) may be carried out two or three times daily, a drying powder being afterward applied.

In follicular vulvitis small collections of pus may be opened and the cavities swabbed out with pure formalin. In the phlegmonous variety abscesses should be opened when they form. When Skene's ducts are affected or continue to discharge pus, they should be swabbed with a small swab soaked in pure formalin. If this is not sufficient, it is best to introduce a fine cautery point and to open them in their whole extent toward the vagina.

When the duct of the Bartholinian gland is affected, an endeavor should be made to apply formalin or nitrate of silver to it. It is usually difficult to introduce a probe further than the orifice. Some authorities advise enlarging the latter with a narrow knife, in order that a thorough application be made. When the Bartholinian gland suppurates, it should be entirely removed by dissection.

In cases in which the vagina is affected, it must be suitably treated (see p. 349). This is particularly necessary in gonorrhea, in order that the infection may be prevented from spreading to the uterus.

EDEMA.

Edema may occur in connection with venereal and other infections. It may be merely part of a general anasarca, due to renal and other causes. It may occur in pregnancy, labor, or the puerperium.

GANGRENE.

The vulva may become gangrenous, as already mentioned in association with various vulvar infections, especially the diphtheric and those occurring in septic and acute febrile conditions, *e. g.*, typhus, measles, scarlatina, and in weak infants. It may follow contusions, edema, or extravasation of blood. The condition is serious, and may be accompanied by general septic infection.

The patient should be kept at rest and the vulva treated with antiseptic applications as above described. When a line of demarcation forms, the necrotic tissue should be removed. The system should be well nourished and stimulated.

ECZEMA VULVÆ.

This affection is found chiefly on the labia majora, but it may affect the mons veneris and other parts.

In the acute condition there is swelling of the skin, with a small vesicular

eruption, itching, and tenderness. Considerable discharge may be produced. Chronic eczema may follow the acute affection, or may be gradual in development. The skin is rough, scaly, and may be fissured and excoriated; it may also be considerably hypertrophied.

Rheumatism is an important factor in predisposing to these attacks; in some cases they occur only in the spring. The scrofulous diathesis may also have an influence.

Treatment.—Locally, in the acute stage, alkaline and bran baths are beneficial, followed by a mild ointment. Boric starch poultices may also be employed. Painting with nitrate of silver gives relief from the heat and itching. The parts should not be scratched. It may be necessary to wear drawers at night to prevent this. Often the following paste cures quickly:

℞. Acidi salicylici,		
Resorcinol,.....	āā	gr. v
Ichthyolici,.....		℥ x
Lanolini,		
Vasellini,		
Zinci oxidi,		
Pulveris amyli,.....	āā	ʒ ij.
Misce leniter terenda diu, fiat pasta.		

In chronic cases, when there is leathery infiltration, compresses of absorbent cotton, soaked in a lotion of water containing one-quarter the quantity of the following mixture, are helpful:

℞. Resorcinol,		
Glycerini,.....	āā	5.0
Spir. vini rect,.....		90.0

This may be succeeded by the above-mentioned paste, or by an ointment containing equal parts of lead-plaster and the best vaselin. Sometimes it is well to paint the parts with iodin.

General measures must not be forgotten. The diet must be simple and the bowels kept regular. The possible influence of rheumatism or scrofula must be kept in mind in carrying out treatment.

HERPES ZOSTER.

This condition is sometimes found. The vesicles may be few or many, discrete or confluent, and, in the early stages, usually surrounded by a ring of congestion. Sometimes large bullæ may be formed. They may give rise to superficial ulcers with crenated edges. A crust usually forms over these, and underneath healing takes place in the course of a week or two. There is generally considerable heat and smarting pain. The inguinal glands may be sensitive. The condition may occur in association with or without local irritating conditions. Rarely, it may develop before menstrual periods; sometimes it is found in pregnancy. It must not be mistaken for syphilids or soft chancre.

Treatment.—The vesicles should be painted daily with flexible collodion, the patient being kept mostly at rest.

Where large bullæ form, they should be pricked with an aseptic needle, and then dusted with boric powder or aristol, and covered with an antiseptic

absorbent dressing. When ulcers form, similar measures should be employed. Pain may be assuaged by cold boric starch poultices or lead and opium lotion.

LUPUS OF THE VULVA—ESTHIOMÈNE (Huguier).

Several varieties are found. There is always some degree of hypertrophy and often ulceration. The ulceration may be very superficial and of a deep red color; it does not usually cause much discharge, though occasionally it may bleed freely. Sometimes a number of nodules may be seen on the ulcer. Healing often takes place in one part as the disease extends in another. It may spread irregularly in various directions, or may excavate the tissues deeply; sometimes, bladder or rectum may be perforated. The inguinal glands are rarely enlarged. Healing may result in considerable distortion of the parts, the urethra being sometimes more or less obstructed. Hypertrophy of tissues may lead to the formation of one large mass or of several independent areas. These swellings are not usually painful.

The disease progresses slowly, and may be mistaken for malignant or venereal disease or for elephantiasis. Tuberculosis is a predisposing cause, and in some cases the affection is, probably, a local tuberculosis, though the bacillus has not been found.

Williams thinks that some of the cases which have been described as lupus are of undoubted tuberculous origin.

Treatment.—The hypertrophied areas should be excised, and the ulcers scraped or cauterized. Antiseptic dressings should be constantly applied.

TUBERCULOSIS OF THE VULVA.

True tuberculosis, in which the bacillus has been found or inoculation results obtained, is very rare. Chiari has reported a case in which infection spread from tuberculosis of the rectum. Deschamps has described a case in which a woman with phthisis injured her vulva, which afterward became the seat of a tuberculous ulcer.

ERYSIPELAS.

Erysipelas is sometimes primary in new-born children. It may be found in women, occurring periodically in association with menstruation. It may develop occasionally in conditions of marked constitutional weakness, especially in connection with the exanthematous fevers and puerperal infection.

VARIX.

A varicose condition of the vulva may be found in connection with large tumors in the pelvis, or in connection with pregnancy. Sometimes, masses of considerable size may be formed, which may cause considerable discomfort. Sometimes inflammation occurs in the vessel-walls or in the skin external to them. Rarely, rupture of veins takes place, spontaneously or as the result of injury.

HEMATOMA.

This may occur in nonpregnant women as the result of a blow, or in pregnant women as the result of injury during labor. The swelling formed may absorb, rupture, or suppurate. Gangrene may sometimes develop.

Treatment.—In the early stages the patient should be kept at rest and cold applications applied to the swelling, the vulva and vagina being washed regularly with an antiseptic lotion; when there is a large mass, it should be opened, the blood-clot removed, and bleeding vessels secured with catgut. When suppuration occurs in a hematoma, the abscess must be opened and drained.

KRAUROSIS VULVÆ.

This condition, first described by Breisky in 1885, is found chiefly after the menopause, but may also occasionally affect women before this period.

The tissues become dry, brittle, and atrophied and are easily torn. In the early stages the affected parts are usually small red areas, varying in size. Later, they have a white, cicatricial appearance. Orthmann states that the progress of the disease is marked by hypertrophy, due to small-cell infiltration, in association with atrophy, the former usually surrounding the latter. The *rete Malpighii* shrinks and may disappear, the skin papillæ shrivel, and the sebaceous and sweat-glands gradually become obliterated. Fissures may develop on the surface. The connective tissue of the corium atrophies and in parts is infiltrated with small cells.

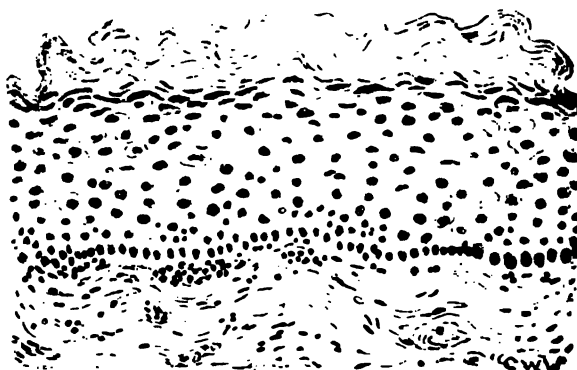


Fig. 176.—Kraurosis vulvæ, intended to show the thickness of the hornified layer, the absence of the papillæ, the density of the connective tissue beneath, and a small round-cell invasion of the stratum lucidum ($\times 265$).

These changes usually begin on the clitoris, labia minora, or vestibule. In the later stages they may spread to the labia majora and mons veneris. The entrance to the vagina may become greatly stenosed. Prolapse of the urethral mucosa or caruncle may be found in these cases.

The **etiology** of the disease is unknown. It has been stated that it is due to old gonorrheal infection. A. W. Johnstone states that in all the cases observed by him some member of the patient's family was troubled with trachoma of the eyelids.

Symptoms.—Sometimes the symptoms are slight. Usually there are intense itching and burning, especially during micturition; there may be some purulent discharge. Coitus is painful or impossible.

Treatment.—The local application of medicine is, in most cases, useless. A. W. Johnstone recommends the application of the yellow oxid of mercury ointment, 4 gr., vaselin, 1 oz. The greatest satisfaction has been obtained by free excision of affected areas, the raw surfaces being covered with adjacent healthy tissue.

PRURITUS VULVÆ.

Pruritus vulvæ is the condition in which there is a feeling of itchiness, more or less constant, in some part of the external genitals.

Etiology.—This condition may be caused reflexly, *e. g.*, by the presence of worms in the rectum, hemorrhoids, and by various diseases of the urinary tract and pelvic organs. It may be due to local irritating conditions, *e. g.*, kraurosis vulvæ, eruptive and inflammatory affections, the drying of diabetic urine on the vulva, discharges from diseases of vagina and uterus, worms in the vulva and vagina, vermin on the skin, congestion of the parts, varicose veins. In other cases, as was demonstrated by me several years ago, pruritus is associated with a slowly progressing fibrosis, affecting both terminal nerves and nerve-endings. Sanger has also described the same changes. Most authorities classify a considerable percentage of cases of pruritus as neuroses. It is highly probable that this is an error, the cases being really those in which the essential feature is the alteration just described as occurring in the local nerves and nerve-endings.



Fig. 177.—Clitoris and portion of labia minora removed for persistent pruritus vulvæ.

Seat of Pruritus.—Most commonly the clitoris and labia minora are affected. The labia majora, mons veneris, hymen, perineum, and inner side of the thigh may also be attacked.

Symptoms.—In some cases the itching is constant, in others paroxysmal. It is usually worse at night in bed, and is also aggravated by movements. Sometimes the condition is so bad that the woman may become a complete nervous wreck. There are cases on record in which suicide has been committed. Local excoriations, eruptions, and hypertrophy of the skin may result from scratching.

Treatment.—Where some distinct cause can be made out, it should be attended to. Various local applications may give relief, *e. g.*, corrosive sublimate (1:1000), boric acid, phenol, nitrate of silver, alkaline lotions, chloroform (2 parts) and oleum amygdalæ (60 parts); ointments containing menthol, cocain, opium, or belladonna. Various drugs have also been used internally, *e. g.*, potassium bromid, sulphonal, arsenic, etc.

In cases which resist these measures it is advisable to carry out *complete removal of the affected part*.

The operation is a simple one. The skin (it may be, the clitoris and labia minora) is removed, and the raw surface closed with continuous catgut and dressed antiseptically.

It is important not to remove parts affected only secondarily, as a result of irritation due to the itching. The central portion should be taken away,

and the surrounding subacutely inflamed tissues allowed to become normal. Sometimes it is necessary to perform a second operation, removing a small portion affected with the primary trouble which was left behind.

In pregnancy only mild measures should be adopted. When the itching is intense and cannot be relieved, it may be necessary to induce abortion.

ELEPHANTIASIS.

This disease is a noncontagious one, in which chronic recurring inflammation with progressive hypertrophy of the skin and areolar tissue takes place, chiefly in the external genitals and the extremities.

Elephantiasis is endemic in China, India, Egypt, the Malay peninsula, Arabia, the West Indies, and parts of the tropics of America, chiefly in districts near the sea. It occurs sporadically in many other places, except in the extreme north and south. It may affect all races, but is mostly found in the dark. It occurs in all ages, being most common in adult and middle life, rarely beginning in young children or in the aged.

The disease is believed to be due to the presence in the blood of *Filaria sanguinis-hominis*, which is probably conveyed by the bites of mosquitos.

The disease begins as a lymphangitis, with fever, the lymphatic glands being usually enlarged. The acute stage generally lasts a week or two and subsides. In succeeding years similar attacks develop, each one leaving the affected parts larger. Chyluria is frequently found. The skin becomes darker, and may be smooth or rough, warty or fissured; it may become ulcerated by friction.

Of the external genitals, the labia majora are most frequently affected, more rarely the clitoris, and most rarely, the labia minora. Large swellings may form which may cause local discomfort and interfere with sexual intercourse.

Pathologic Anatomy.—In most cases there is a general hypertrophy of the skin and all subjacent tissues, the lymphatics being markedly enlarged. Frequently puncture of the swelling, especially in the acute stages, leads to the escape of a milky fluid resembling chyle.

Prognosis.—The disease rarely disappears when once it has started. It does not usually affect the general health nor shorten life, but in some cases rapidly succeeding thrombosis may cause marked debility, or pyemia may develop and endanger life.

Treatment.—In the early stages change of residence to a cold climate is advisable. Local soothing applications may be used in the febrile condition. In young persons sulphid of calcium (1-1½ gr. twice daily) is reported to have checked the disease. In cases of long standing excision of the diseased part is necessary.

TUMORS.

Carcinoma.—Primary cancer of the vulva is very uncommon. It most often develops at the junction of the labia majora and labia minora; also in the clitoris, at the urethral orifice, on the perineum, and in the Bartholinian ducts and glands. The squamous cell variety is mostly found, adenocarcinoma developing only from the glands of Bartholin.

It usually begins as a hard nodule in the skin. This may protrude and

become warty, or ulceration may take place, leading to a blood-stained discharge. When it begins on one side, the opposite labium may become infected, apparently by contact inoculation. Surrounding tissues gradually become involved. There is no tendency to spread up the vagina, save when the disease affects the urethral wall. The inguinal glands become affected. Metastases develop in different parts.

Symptoms.—Pruritus is the earliest symptom. It may be very marked when the clitoris is affected. A discharge is produced, which is irritating to surrounding parts. Pain and marked hemorrhage occur usually only in the advanced stage of the disease. There may be micturition troubles.

Sarcoma.—This is very rare. It may be round or spindle-celled or melanotic.

Differential Diagnosis of Malignant Disease.—The following conditions must be

diagnosed from carcinoma and sarcoma: simple tumors, lupus, hard and soft chancre, papillary growths, warts, or condylomata.

Treatment.—In the early stage of the disease removal by surgical measures

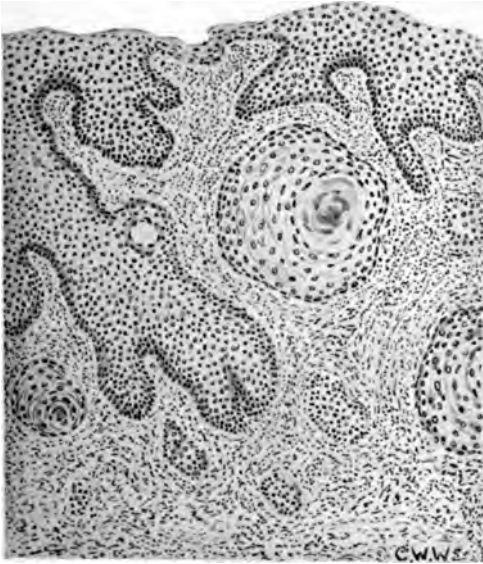


Fig. 178.—Cancer of vulva ($\times 55$).



Fig. 179.—Cancer of vulva ($\times 36 \frac{1}{2}$).

PLATE II.



Primary epithelioma of the left labium. The illustration shows the labia drawn apart, their inner surfaces white, due to sodden epithelium.

is advisable. The dissection should also be extended to the inguinal region in order that the inguinal glands and the lymphatics leading to them from the vulva should be removed. When the glands are definitely enlarged, there is very likely to be a recurrence of the disease at a later period.

Sometimes it is advisable to take away the vulvar growth in order to diminish the patient's local distress. In inoperable cases, palliative measures must be employed. Necrotic tissue may be swabbed with pure formalin from time to time or destroyed with the actual cautery. The affected areas must be frequently washed with antiseptic lotions and covered with dressings.



Fig. 180.—Recurrent carcinoma, eighteen months after removal from the left labium. The left inguinal region is involved.

The healthy neighboring skin must be protected from the discharges by the application of borated vaselin.

Papillary Growths, Warts, Condylomata, Vegetations.—In dirty conditions of the vulva, especially in children and in pregnant women, warty growths may develop on the vulva, perineum, around the anus, or in the vagina, in association with venereal affections. They may be simple or multiple, and may reach a large size in some cases. They may be deeply congested and give rise to a discharge which has often a foul odor; they may become fissured or inflamed, and may cause pain.

Treatment.—Complete removal is best. This should be carried out with knife or cautery even if the woman be pregnant.

Fibroma, Fibromyoma, Myxoma.—These growths are rare. They are mostly found in the labia majora.

Lipoma is sometimes found, especially in the mons veneris.

Enchondroma is very rare. It is sometimes found in the clitoris.

Cysts of the Vulva.—Small cysts are sometimes found in the vestibule, labia minora, and clitoris; occasionally in the hymen. Usually they are simple. A few cases of multilocular cysts of the clitoris have, however, been described. They may be found at the urethral orifice, possibly due to the occlusion of Skene's glands. Sebaceous cysts may occur in the labia majora.



Fig. 181.—Section through a Bartholinian abscess ($\times 9$).

In the latter may also be found an encysted hydrocele of the round ligament, blood cysts, dilated lymphatic cysts, dermoids. The most frequent cystic swellings are those which occur in the Bartholinian or vulvovaginal glands.

Distention Cyst.—In one set of cases these result from closure of the duct of the gland by vulvovaginitis, chiefly of gonorrheal origin, the acini of the gland becoming distended.

These cysts may vary in size from a marble to an egg. They may be round or ovoid, smooth or lobulated. They occur chiefly on the left side, but may be right-sided or bilateral. The contained fluid may be colorless or yellow mucus, or a mixture of mucus and blood. The duct of the gland as well as the gland may be distended. In the former case the swelling is small and near the vagina, into which it projects; it may discharge from time to time, and refill. In the former case the swelling usually becomes large, and is more external than the other. Sometimes the skin may be so thinned over the cysts as to make them somewhat translucent.

Bartholinian Abscess Cyst.—Another variety of cyst is that due to purulent distention of the gland (Bartholinian abscess). It may develop acutely, or as a chronic process in a preëxisting cyst. Sometimes the duct alone is involved, leading to the formation of a small abscess.

Physical Signs.—In the acutely developed condition there is a localized tender swelling on one side of the vulvar slit. There are more or less congestion and edema of the tissues surrounding the diseased gland. Palpation causes pain, and, when there is considerable pus in the abscess, fluctuation may be detected.

Frequently the abscess bursts on the inner side of the labium.

Suppuration may extend to surrounding tissues, and, rarely, may burrow through the rectum or perineum. After it bursts, fistulæ may remain for a long time; sometimes ulceration develops at the seat of rupture.

When the abscess is slowly produced by suppuration in a preëxisting cyst, there are usually no signs like those found in acute abscess formation. The labial swelling enlarges and becomes more sensitive.

Symptoms.—There is discomfort in walking and in coitus, and in the acute condition severe pain, elevation of temperature, and, often, frequent and painful micturition.

Differential Diagnosis of Bartholinian Cysts.—1. From hydrocele of the round ligament. 2. From hernia of the ovary. 3. From hernia of bowel or omentum. 4. From cyst of the gland along with hernia. 5. From other cysts of the labium majus. 6. From perirectal abscess. 7. From a vaginal cyst.

Treatment.—In acute conditions the abscess should be opened and drained. After a few weeks the affected gland should be dissected out of the tissues and the raw surface closed. In chronic cases the cyst should be removed by dissection.

VENEREAL AFFECTIONS.

I have already described the changes produced by gonorrhea (see "Vulvitis"). The syphilitic chancre usually develops after an incubation period of about a month, and appears as a small, red, indurated lump, which often ulcerates. It is generally single, but may be multiple. It usually develops on the labia majora or minora; sometimes on the clitoris or fourchet; rarely on the vaginal wall or cervix.

It is to be noted, however, that the primary syphilid is very often never noticed either by the patient or by her physician, the characteristic induration being often absent; it may be accompanied by some other affection, *e. g.*, chancroid or gonorrhea.

In secondary syphilis mucous patches and papular eruptions may develop on the vulva.

In tertiary syphilis gummata may form and may ulcerate. The inguinal glands in syphilis enlarge somewhat, are very hard, and do not tend to suppurate.

Soft chancre, or chancroid, usually develops within twenty-four hours after infection, and may be single or multiple. It begins as a small vesicle or pustule, which bursts and gives rise to an ulcer with a yellow base and a sharp, red edge. It discharges freely, and in weakly or alcoholic women it

may slough or assume a phagedenic form. The inguinal glands are usually infected and often suppurate.

Treatment.—The treatment of vulvar gonorrhea is described on p. 335.

In primary syphilis the vulvar hair should be shaved and the genitalia frequently cleansed by irrigation or by the application of gauze soaked in formalin solution (25 or 30 drops to a pint). Where there is much induration, blue ointment may be rubbed in and applied with lint. When there is phagedena, the unhealthy tissue may be removed by burning with the cautery, or by repeated applications of pure formalin. Sometimes it is necessary to remove masses with the curet.

Mucous patches should be touched with pure formalin or silver nitrate.

Tertiary gummata usually disappear under the use of iodid of potassium internally.

Soft chancre should be destroyed with pure phenol, formalin, or the cautery, the affected parts being kept from contact with others by pieces of absorbent cotton soaked in a solution of formalin (30 drops to a pint). Vaginal injections of this solution should be given two or three times a day.

Inguinal bubo in the early stage may be treated by inunction of Credé's ointment. If suppuration occurs, the abscess must be opened and drained.

In all cases general hygienic, dietetic, and medicinal treatment is necessary.

Wounds of the Vulva.—See p. 297.

Hernia into the Vulva.—Hernia of the intestines and omentum may be found in the vulva, having descended either through the inguinal canal or femoral opening. There is a much rarer variety in which the hernia descends posterior to the broad ligament, between the rectum and vagina, and extends into the labium or perineum; this form may be readily mistaken for a Bartholinian cyst. In another rare form the hernia may descend in front of the broad ligament, between the bladder and the vagina, and bulge into the labium.

CHAPTER XI.

AFFECTIONS OF THE VAGINA AND HYMEN.

VAGINITIS (COLPITIS).

Pathology.—In acute catarrhal vaginitis the mucosa is congested and edematous; the papillæ are markedly hypertrophied, owing to infiltration. The epithelium over them may become thinned by exfoliation, so that small round red areas resembling granulations are produced—the so-called *granular vaginitis*. The discharge is slightly acid or alkaline. If due to gonorrhea, it is creamy and purulent, gonococci being found in the fluid, the leukocytes, and epithelial cells of the discharge.

In chronic cases the inflammation may be found only in isolated areas. Sometimes a rough, granular condition of the entire vaginal wall is produced.

In *senile vaginitis* the mucosa is usually affected in patches, which appear red, owing to the shedding of epithelium. They tend to adhere to one another, leading to cicatrization and shrinkage of the walls. Sometimes the cervix may be completely shut off in this way.

In *diphtheric vaginitis* the wall becomes swollen and covered with the characteristic membrane. The term is sometimes wrongly applied to the condition found in connection with severe septic affections or in the acute exanthemata, in which there is a superficial exudate—*exudative* or *croupous* vaginitis.

Exfoliative vaginitis is a condition described by Farre, in which periodic exfoliation of the vaginal epithelium is said to occur.

In severe phlegmonous vaginitis the vaginal wall may necrose and be thrown off, a condition sometimes termed dissecting vaginitis or perivaginitis. It is chiefly found in puerperal and exanthematous infections. The raw areas may become adherent and cicatrize, causing atresia.

Winckel has described a condition known as *emphysematous vaginitis*, in which little cysts occur containing gas, accompanied with swelling of the parts and a discharge; this affection has been found mainly among pregnant or puerperal women.

Etiology.—At the present time the tendency is to regard all forms of vaginitis as dependent upon the action of micro-organisms. In the normal healthy adult the vaginal wall is very resistant to their action, but if its vitality be impaired from any cause, or its epithelium be thinned or softened, as in childhood, pregnancy, the puerperium, old age, or general depreciation of health, it may be attacked. One of the most frequent infecting organisms is the gonococcus. There has been some difference of opinion in regard to its power of attacking the vaginal wall directly. Bumm was the first to state that it could not develop in the stratified squamous epithelium of the adult vagina, but only in the epithelium lining the urethra and cervix. He placed gonococci in the vagina for twelve hours in several cases without setting up

any vaginitis. He also excised a portion of the vaginal wall in a severe case of gonorrhea, and found, on microscopic examination, no gonococci in it. The swelling and tenderness in the vaginal walls he, therefore, regarded as due to irritation from the vulvar and cervical discharges. He has, however, modified these views, and now believes that occasionally in the adult a true acute gonorrheal vaginitis may occur, *e. g.*, when the vaginal epithelium is very soft or thin.

Schwarz, Touton, Dinkler, and others have opposed Bumm's original views. Sanger believes that the vagina is attacked only when its wall is delicate, thin, or impaired in vitality, *e. g.*, in infancy and youth, in pregnancy, and in senile conditions. Mandl has carefully examined excised portions of the vaginal wall in several cases of gonorrhoea. He found the subepithelial connective tissue infiltrated with abundant leukocytes; the epithelium was thinned in parts so that the papillae were almost exposed; in other places it was infiltrated with pus-cells. The whole wall was deeply injected and had a red, raw appearance. Gonococci were found on the surface and in the entire thickness of the epithelium, many also being within leukocytes. In various parts they were found in the subepithelial connective tissue, having penetrated most deeply where the epithelial layer was thinnest.

Mandl points out that it is important to examine sections of the vaginal wall in the early stages of the disease. At later periods the dead or degenerating cocci may fail to take on the stains.

The pathogenic micro-organisms of suppuration may also set up vaginitis if they enter the vagina in sufficient numbers, and find abundant nidus in which to develop; any weakened condition of the vaginal wall is a favoring cause.

Possibly certain saprophytic organisms may be a cause under favoring conditions.

In some cases microbes higher than bacteria may set up vaginitis, *e. g.*, *Oidium albicans*, *Monila candida*, and *Leptothrix vaginalis*.

The favoring conditions for the development of vaginitis are many. Discharges from the uterus: these act by softening the vaginal epithelium and by affording an alkaline medium in which the microbes may develop. Irritation of the vaginal walls from worms, fistulous communication with bladder or rectum, from tumors, prolapsus uteri, pessaries, douches, examination or operative procedures, excessive coitus, masturbation, horseback-riding, the use of a sewing-machine; certain constitutional conditions weakening the tissues or causing desquamation of epithelium, *e. g.*, the exanthemata, dysentery, tuberculosis, diabetes, anemia; pregnancy, the puerperium.

Symptoms.—In acute cases there are heat and pain in the vagina; increased secretion, which may give rise to a pruritus; pain and frequency of micturition when the urethra is involved; pain on coitus. Where the condition is of the phlegmonous or erysipelatous variety, there may be considerable constitutional symptoms. In chronic cases the discharge is the chief complaint, though there may be, as well, a feeling of heaviness, smarting, or pain on coitus. A protracted case may lead to a weakening of the health.

Physical Signs.—On examination in the acute stage the vagina is hot and the movements of the fingers cause pain. In the granular form the hypertrophied papillae may be felt. Through the speculum the redness of the wall

is visible, and the granular condition, if it exists. When the urethra or Skene's glands are affected, pus may be squeezed from them. Generally, also, in gonorrheal cases, it can be forced from the orifices of the Bartholinian ducts. In chronic cases the vagina may be more congested than normal and the wall may sometimes be thickened.

Vegetations may sometimes be found in gonorrheal cases or in nongonorrheal vaginitis of pregnancy. In the senile form adhesions may be felt, and reddened patches may be visible. It is important to note that a pelvic abscess discharging into the vagina may be mistaken for vaginitis.

Prognosis.—In most cases of nongonorrheal inflammation the disease is curable; the most unfavorable are those in which irritation of the vaginal wall is kept up by discharge from cancer of the uterus or from a fistula.

Gonorrheal inflammation is a serious matter, because of the difficulty of curing it, and because of the complications which may follow after the subsidence of all acute symptoms. The infection may remain in localized areas for a long period. It may invade the Bartholinian glands, the whole uterine mucosa, the Fallopian tubes, ovaries, and peritoneum. In children, in elderly women, or in weakly adults it may also remain in the vaginal mucosa for a long period. I have already referred to the question as to whether in these cases the gonococci act alone or with other germs which develop in the secretions along with the former (see p. 136). In these chronic cases, weakening conditions, *e. g.*, general diseases, fatigue, the puerperium, may cause a recrudescence of activity in the affection.

Treatment.—In the acute stage the patient should lie in bed for a week or more. The diet should be simple and the bowels should be kept freely open.

In gonorrheal cases the following procedure may be employed: The patient is placed in the lithotomy position and the vulvar hairs shaved. The vagina is thoroughly washed out and the uterine cavity swabbed with pure formalin. The vagina is then packed with a strip of gauze soaked in a solution of formalin in glycerin and water (formalin, 40 min.; glycerin, 6 oz.; water, 14 oz.). In carrying out this procedure it may be necessary to anesthetize the patient.

A pencil of iodosyl should be placed in the urethra. If vulvitis be present, the measures described on p. 335 should be employed.

In twelve hours the vaginal gauze is removed and the vagina is irrigated with a solution of formalin in water (20 min. to 1 pint) two or three times a day. If this causes much distress, another solution should be substituted, *viz.*, normal saline, or the following: borax, 1 dr.; tincture of opium, 1 dr.; water, 1 pint. In three or four days the uterus should again be swabbed with pure formalin and the vagina packed for twelve hours with gauze saturated in formalin solution.

Each day one or more pencils of iodosyl should be placed in the urethra. In the early stages it may be necessary to give morphin to allay pain. In exudative vaginitis the treatment is the same as in gonorrheal cases.

In the chronic stages irrigation with formalin solutions (20 min. to 1 pint), lysol, or creolin (1 per cent.) may be used. Sometimes it is advisable to swab the vagina with a solution of silver nitrate (10 gr. to 1 oz.) twice a week. General tonic treatment is often necessary.

In phlegmonous vaginitis, where separation of portions of the wall occurs, the healing process may be associated with narrowing of the vagina and with adhesion of apposed surfaces. The latter must be prevented by the insertion of tampons or glass cylinders.

Vaginitis in children is difficult to treat satisfactorily. In severe cases it is advisable to give an anesthetic in order that the hymen may be thoroughly dilated. A strip of gauze soaked in a solution of formalin, one-quarter the strength employed in the adult, is then placed in the vagina for six or eight hours. Thereafter, vaginal irrigation may be carried out twice or thrice daily. Some authors use exclusively in these cases a solution of potassium permanganate (1:3000).

VAGINISMUS.

This condition is an excessive hyperesthesia of the vulva, whereby spasms of muscles occur when coitus is attempted or when the physician tries to make a vaginal examination. In some cases there is hyperesthesia without contraction. The condition is usually found in nulliparæ, but may sometimes be present in multiparæ.

Etiology.—Vaginismus is generally found in young and nervous women. It may occur when no local lesion can be detected. Generally, however, one or other of the following conditions is present: tender carunculæ myrtiformes; unruptured sensitive hymen; fissures or sores of the vulva or anus; polyp; prolapse or caruncle of the urethra; inflamed areas. Contractions may occur in the sphincters of the vagina, levator ani, sphincters of the anus, and other perineal muscles.

Differential Diagnosis.—The condition must be distinguished from dyspareunia, imperforate hymen, and atresia vaginæ.

Treatment.—Operative treatment is generally necessary in this condition. If the cause be any local irritation, *e. g.*, urethral caruncle, it must be treated; if there is a tender hymen or carunculæ myrtiformes, these are to be cut away, and the vaginal orifice somewhat stretched. Fissures around the vaginal orifice or in the anus are to be divided or stretched.

If no local cause can be discovered, contraction of the sphincter vaginæ occurring reflexly when penetration is attempted, stretching of the vaginal entrance by means of large dilators as well as by the fingers, should be performed. Or the fibers of the sphincter vaginæ may be cut on each side of the fourchet, the ostium vaginæ being afterward stretched.

After all these procedures, a glass or vulcanite tube should be placed in the vagina and retained while the patient lies in bed and after she sits up, for two or three weeks after the operation. It is held in position by a perineal pad and T-bandage. The tube should be removed each day in order that it may be cleansed and the vagina douched.

When the ovaries, tubes, or other pelvic structures are inflamed, appropriate measures must be carried out.

General tonic treatment may often be necessary in these cases, patients being frequently depressed in health, nervous, and even hypochondriacal.

TUMORS OF THE VAGINA.

Cysts.—Cysts are rarely congenital. They are mostly found in adults. Small cysts may be sometimes scattered over the vaginal walls, due, according to Winckel, to inflammatory changes.

Larger cysts are also found, varying in size from a bean to a walnut, or even larger. They are mostly found on the anterior wall, but may occur on the posterior. Some are probably derived from dilation of lymphatics or from extravasation of blood.

They are usually single, but there may be more than one. Poupinel has described a case of multilocular cyst. Sometimes the cyst may be high up, sometimes low down; rarely the hymen may form part of the wall. Sometimes they become pedunculated.

The vaginal mucosa may be so thinned over the cyst that it is somewhat translucent. The lining of the cyst may consist of columnar (sometimes ciliated), flattened, or pavement epithelium; in some cases no epithelial lining can be made out; Kaltenbach and Graefe have described papillæ attached to it. The contents vary, being clear and viscid, yellowish, turbid, or dark.

It is possible that sometimes a cyst may be formed by gradual occlusion of the neck of a urethrocele. Sometimes the cyst may be found with a vertical mesial vaginal septum (these are believed by many to be of Müllerian origin).

Dermoid cyst of the vagina is very rare.

Symptoms.—There may be no symptoms if the cyst be small. If large, there may be a bearing-down feeling and discomfort in walking. Leukorrhea may be caused by its irritation.

Differential Diagnosis.—These cysts must be distinguished from cystocele, urethrocele, rectocele, periurethral cysts, swellings external to the vagina, *e. g.*, hernias, labial cysts, inflammatory masses, etc.

Treatment.—Cysts should be removed. A longitudinal incision is made through the vaginal mucosa over them. The cyst should then be dissected out, and the raw cavity closed with continuous catgut suture. If a communication exists between it and the urethra, the edges should be pared and closed with sutures.

When dissection would be dangerous because of the risk of injuring the bladder, ureter, or bowel, only the superficial part of the cyst should be excised with a portion of the vaginal wall over it, the bottom of the cyst being left undisturbed. The edges of the incision are sutured with continuous catgut in order to check bleeding.

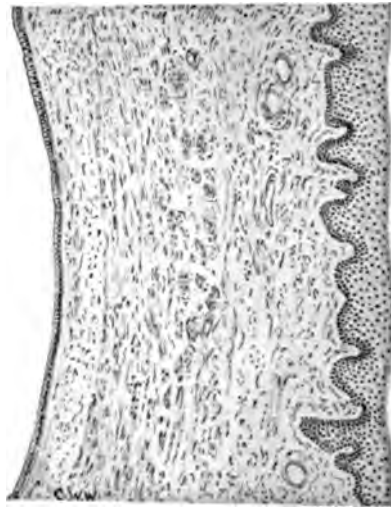


Fig. 182.—Cyst of vaginal wall lined with low cubic epithelium; outer surface shows normal vaginal mucosa ($\times 49\frac{1}{2}$).

Fibroma and Fibromyoma.—These are rare. In 70 reports of cases studied by Machenhauer most were noted in women between forty and fifty years of age. They varied from the size of a cherry to that of a fetal head. They are found mostly in the upper part of the anterior wall, and are chiefly sessile; a few are polypoid. The surface may occasionally ulcerate. They may be adherent to the urethra.

Diagnosis.—Small tumors may cause no trouble. Larger ones may cause a feeling of weight and discomfort. Leukorrhea may be present; micturition troubles may occur. There may be difficulty in coitus. Other symptoms may arise, due to changes in the tumor, *e. g.*, inflammation, sloughing, etc.

The condition must be diagnosed from uterine tumors, prolapse, or inversion of the uterus; when sloughing or ulcerated, it may be mistaken for malignant disease.

Treatment.—The vaginal wall and capsule should be opened and the tumor shelled out. When the tumor is pedunculated, the pedicle should be ligated and the growth removed. If the tumor be very large, its removal may be difficult, owing to its relation to neighboring structures. Sometimes it is possible to remove only part of the mass.

Carcinoma.—This disease is rare as a primary affection. Out of 4628 cases of primary carcinoma in women tabulated by Roger Williams, only forty were vaginal, whereas 1571 were uterine (not one being tubal). In most cases it is secondary to disease in neighboring structures, *e. g.*, vulva, bladder, cervix uteri, especially the latter, growing by extension from the primary growth or implantation. It may occur as a squamous-cell growth or as an adenocarcinoma.

The former generally grows on the posterior vaginal wall; the other varieties begin in nodules which tend to spread by infiltration. Sometimes the vagina may be completely surrounded by the disease. Ulceration usually occurs over it. When the lower part of the vagina is attacked, the inguinal glands enlarge.

The *symptoms* are the same as in cancer of the cervix. The early condition must be diagnosed from a hard or soft chancre.

Treatment.—If diagnosed early, the mass may be removed. When advanced, palliative measures only can be employed. Extirpation of the vagina in bad cases, in which the posterior wall is affected, has recently been advocated by several authorities. Olshausen operates as follows:

The perineum is divided obliquely, and the rectum separated from the vagina, the pouch of Douglas being pushed up. As much of the wall as is necessary to remove the growth completely must then be removed. Where the uterus has to be removed as well, the pouch of Douglas is opened.

Martin advises beginning with an incision around the introitus, the vaginal wall being dissected away as a tube as far up as the cervix. The entire uterus is then removed. The peritoneum is drawn as low as possible and the opening in it closed.

The most complete removal can be obtained by Schuchardt's method, by which the vagina, uterus, and considerable adjacent connective tissue may be excised (see p. 578).

Sarcoma.—This disease is very rare. It may occur at various ages,

most frequently in infancy. Gatti has studied reports of 27 primary vaginal sarcomata, of which 17 occurred in infants. In a considerable proportion of those occurring in infancy the condition is present at birth. These growths are usually polypoid and consist mainly of round cells, myxomatous tissue being often found.

In the adult various forms of growth are found and they usually grow from the lower part of the vagina. They may be soft and rapidly growing or firm and slow growing. Rarely the tumor is melanotic. The growths are usually hemorrhagic, and are often ulcerated and infected. As the disease spreads, various neighboring structures tend to be invaded. Growth is rapid.

The disease must be diagnosed from cysts, fibroids, cancer, syphilids.

Treatment.—The same as in cancer of the vagina. Eiselberg reports an interesting case in which the rectovaginal septum was involved. He resected the coccyx, extirpated the whole disease, and made an artificial anus in the posterior part of the wound. The uterus was pulled down and fastened, so that the wound could be thoroughly closed. The disease generally occurs quickly after local removal.

Primary Syncytioma.—Several cases have been described in which primary growths developed in the vagina similar to some of those described in connection with the uterus, as chorioepithelioma, syncytioma, etc. One of the most interesting is a case reported by Schmit, in which two months after an abortion a nodule developed on the anterior vaginal wall. It was excised and consisted of blood-clot, chorionic villi undergoing hydatidiform degeneration, syncytium, and proliferating Langhans' cells. The uterus was curetted and was found to be normal.

In these cases early removal of the swelling is indicated. Recurrence or distant metastases are likely to take place.

Tuberculosis of the Vagina.—This is more frequent than vulvar tuberculosis, and is most common between the ages of twenty and forty. It is usually secondary to disease in the upper genital tract, though it may occur independently.

It may exist when the uterus is not diseased, but when the tubes are affected; it may be secondary to peritoneal, rectal, or vesical tuberculosis; or it may be found with distant tuberculosis only. It is possible that tuberculosis may sometimes be primary in the vagina or on the vaginal portion of the cervix. It may be found in the miliary or ulcerated form. The ulceration is shallow and irregular in outline, its base being covered with granulations and caseous matter; around it miliary tubercles may be found. The ulcers may perforate bladder or rectum. The disease is nearly always found on the posterior wall and on the upper third; this is to be associated with the spread of infection from the uterus.

Treatment.—Tincture of iodine, iodoform, or lactic acid may destroy the disease and lead to healing by healthy granulations. If this will not suffice, the ulcer may be excised and the raw surface closed with sutures. The Finsen or x-rays may prove beneficial.

Venereal Warts or Vegetations.—These growths, which have already been described in connection with the vulva, where they more frequently occur, may sometimes be found in the vagina. The treatment is the same as that described on p. 344.

STENOSIS AND ATRESIA OF THE VAGINA.

These conditions may be congenital or they may result from injury.

1. **Acquired.**—In most cases of acquired stenosis or atresia difficult labors account for the condition. Laceration of the vagina followed by inflammation and after-cicatrization may cause stenosis. Sloughing of parts, owing to compression against the sacrum or the pubes, may be followed by great contraction.

Injury may also be produced in other ways, *e. g.*, by long retention of a pessary, application of caustics or cautery, scalding from a hot douche, various diseases, *e. g.*, lupus, syphilitic ulceration, cancer, gangrene, vaginitis.

The cicatrices may be found in any part of the vagina. Those resulting from injury in labor are usually situated in the upper portion. They may

extend completely or partially around the vagina.

Symptoms.—These vary according to the degree of the affection. They may develop slowly as cicatrization advances, and may be retarded somewhat if coitus be frequent. If sufficient space be left for the escape of the menstrual flow and for coitus, the patient may notice nothing until the contraction be well advanced. When the passage becomes very narrow, there may be painful menstruation or difficult coitus.

When complete atresia takes place, the menstrual discharge accumulates

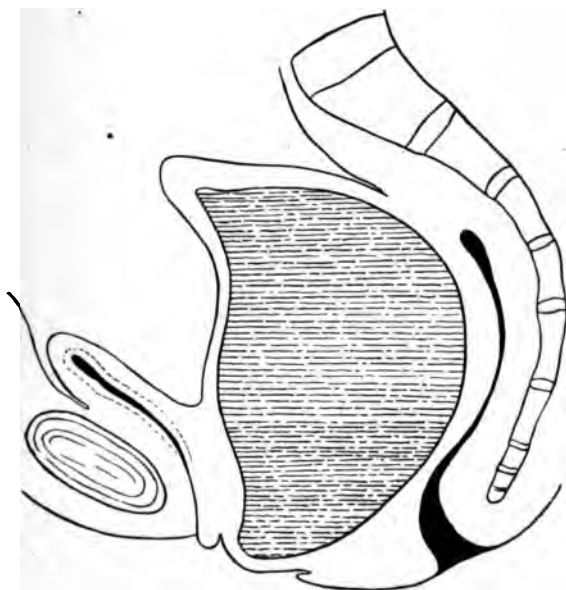


Fig. 183.—Atresia of hymen, with distention of vagina and uterus by retained menstrual blood.

behind the contraction, and the same results follow which I shall describe in connection with congenital atresia.

Treatment.—In the nonpregnant state the cicatricial bands may be cut in different places; the vagina should then be fully packed with gauze for a few days, and afterward glass or vulcanite dilators should be employed. In some cases where there is a thick cicatrix, it may be better to excise it and to transplant a fresh flap of vulvar skin.

2. **Congenital.**—Various malformations will be described in connection with those of the uterus.

Stenosis may exist as an abnormal narrowing of the vagina along with a normal uterus. It may be due to fetal vaginitis, annular, oblique, or spiral ridges or bands being formed. Some authorities think that the so-called

supplementary hymen arises in this way. Arrested development of the Müllerian ducts may also cause the condition. Sometimes only one of these may contribute to the formation of the vagina.

Atresia may be found in different parts. Most frequently the hymen and lower end of the vagina are affected. Sometimes a complete or partial septum exists at some higher level.

Rarely, the whole vagina is solid, and may be represented only by a thin fibrous or fibromuscular band.

Complete absence of the vagina (*defectus vaginæ*) may be considered in this connection. In this condition there is not a trace of tissue between the rectum and bladder. This condition is mostly found in monstrosities. According to Ballantyne, it is probably always associated with absence of uterus, tubes, external genitals, and with imperfect development of the mammae.

Changes Resulting from Atresia.—These usually do not develop until puberty. When menstruation begins, blood accumulates above the atresic portion leading to gradual dilation of the genital tract, viz., vagina, uterus, tubes. Hypertrophy of the vaginal wall may occur in the early stages, but later it becomes thin and may rupture. Rupture of the dilated Fallopian tubes may also occur. The retained blood is at

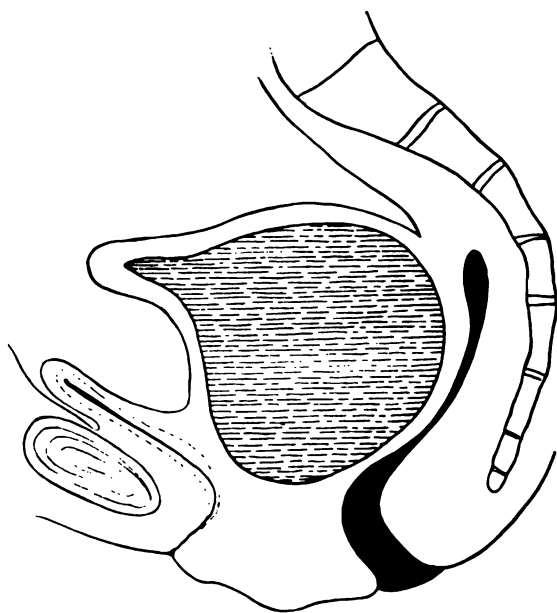


Fig. 184.—Atresia of lower part of vagina. The upper part and the uterus are distended with blood.

first thick and brown. Later it becomes paler; fibrin forms on the walls, and blood-crystals get deposited. The uterine mucosa may have an eroded appearance; its glands may be almost entirely destroyed, inflammatory changes may take place in it, and suppuration may occur. Sometimes the atresic portion may rupture or slough through. Pelvic peritonitis is often found, especially near the tubes, when they are distended. Several variations are found as regards the extent to which the parts above the atresia are affected. I have described an interesting case* in which the dilation was most peculiar. The patient, a girl of eighteen, had complained of an abdominal swelling and pains for three years. There was an atresia of the lower portion of the vagina, and yet there was only slight dilation of the upper portion and of the cervix uteri, the corpus uteri being unaffected.

*"Amer. Jour. of Obstet.," vol. xxxii.

Only the left tube was distended with blood. A. R. Simpson removed this tube, the left ovary, and the right appendages. The patient recovered from the operation, but died two months later from peritonitis. At the autopsy some dilation of the vagina and cervix was found, and this may have mainly developed from intra-uterine hemorrhage and inflammation succeeding the operation.

It is generally believed that in atresia of the lower vagina the distended



Fig. 185.—Atresia of lower third of vagina. Distention of the upper part of the cervix uteri with blood is seen (from a frozen section).

upper part of the vagina forms a large part of the retention tumor, and that this develops even before there is any accumulation in the uterus. Usually, both tubes are affected, unilateral distention being found only where there is atresia of one-half of a double genital tract. The source of the tubal blood in the above-mentioned case is not certain. It was either entirely tubal or derived from the menstruating uterine mucosa, the blood having been forced into the tube; or it was a mixture of both. In favor of the first hypothesis is the fact that, at the examination of the patient before operation, no distention of the uterus was found—a condition never before

described in a case where a patient had menstruated and had retained the discharges for one or more years.

Various authorities believe that, in menstruation, blood is poured from the tubal as well as from the uterine mucosa, and that one of the chief causes of the hematosalpinx in atresia cases is the retention of this tubal flow. Recent observations, however, seem to show that tubal menstruation occurs only rarely. If it took place in the above-mentioned case, it is remarkable that the tubal distention was found only on one side. If the blood was uterine in origin, it is remarkable that the reflux should have taken place only into one tube, if the lumen in both were patent, and it is strange that the interstitial part of

the tube should not have been distended. If the reflux hypothesis as to the origin of the tubal blood be not true, then either no blood had escaped from the uterine mucosa or, having done so, reabsorption must have taken place.

Symptoms.—Sometimes the accumulation of mucus may lead to the formation of a swelling before puberty. Usually, however, no distinct symptoms develop until after puberty. The menstrual periods recur, and there are all the usual signs save escape of blood. Pelvic pain is felt, increasing in duration as the girl grows older, until in many cases it may be continuous. In other cases the pain may not tend to become continuous, but to be felt only at the menstrual periods. In some cases there is very slight distress, owing to the small quantity of blood produced. The patient may complain of micturition or defecation troubles, and of an abdominal swelling, as well as of one at the vulva.

Physical Signs.—On inspection of the external genitals, in case of hymeneal atresia, a bulging may be seen in the position of the introitus vaginae. It may have a bluish tinge, and resemble a bag of membranes. If the lower part of the vagina be atresic, a similar bulging may also be seen, and often the hymen may be made out below it and distinct from it. The urethral orifice is usually dilated. In atresia of the upper portion of the vagina no bulging is seen at the vulva.

On abdominorectal bimanual examination the distended portions may be felt as an elastic swelling. Sometimes, as in the case to which I have alluded, there is no distention of the vagina above the atresia.

If the case be an early one, the uterus is felt to be hypertrophied above the vaginal swelling. Later, the cervix usually dilates, and afterward, the body. Then one or both of the Fallopian tubes may dilate; but, as I have shown, tubal distention may occur without distinct uterine or vaginal retention.

When the vagina is completely atresic, a sound passed into the bladder may be easily felt per rectum. Yet in a case where there is atresia of only the lower portion, the upper part being normal and undistended, this method of examination may lead to a false diagnosis. When the whole vagina is congenitally wanting, the uterus is usually malformed, though sometimes it is not.

Treatment.—The condition should be operated upon as soon after puberty as it is discovered; sometimes before puberty, owing to the accumulation of mucus, interference may be necessary.

The condition of the tubes should be carefully examined. If they are distended, they should be removed first of all. When very slight distention is present, it would be justifiable simply to remove the fluid from the tubes, and to open their fimbriated ends, in the hope that they may recover their functional activity.

If an abdominal section be performed for the treatment of the tubes, the vaginal condition should be attended to after the patient has thoroughly recovered. If the vagina is entirely wanting, the tubes and uterus should be removed; the ovaries should not be taken away unless they are diseased.

When the whole vagina is atresic, a new vaginal slit may sometimes be made by tunneling the rectovesical septum. This is carried out with bistoury, scissors, and fingers. Care should be taken not to injure bladder, ureters, or rectum. A sound should be held in the bladder by an assistant during the operation.

The operation is more difficult when there is no accumulation of blood above the atresic portion. In such a case the uterus should be pushed downward through the abdominal wall by an assistant, in order that the operator may be better able to work his way to the cervix. It is important to dissect portions of the labia free to a considerable extent and to turn them into the newly made raw canal, where they should be stitched. They thus help to form a vaginal wall.

Whenever an atresic vagina or hymen is incised, the retained fluid above it is allowed to drain away slowly. The opening is then made as large as possible, and a glass tube introduced. The patient is kept in bed until the freshly rawed surface granulates and heals. Thereafter the glass plug should be worn for a year or more (except at her menstrual periods), and the girl should be taught how to remove and clean it, and to give herself a daily vaginal douche.

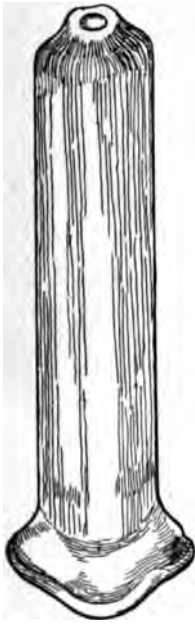


Fig. 186.—Glass tube worn in vagina after operation for atresia.

Atresia of One Half of a Septate Uterus and Vagina.—Sometimes the lower end of one half of a septate vagina may be atresic. This leads to the accumulation of blood on this side, forming the condition known as lateral hematocolpos. If there is a septate uterus, the corresponding left half of the latter may also be distended—lateral hematometra. Sometimes the uterus may be malformed. In some cases rupture of the vaginal sac may take place into the patent vagina. Infection of the accumulated blood may lead to the formation of pus—lateral pyocolpos; cellulitis or pelvic peritonitis may also be produced.

Symptoms.—There may be some accumulation of mucus behind the vaginal atresia before puberty. Usually, however, it is only when menstruation begins that marked symptoms occur. There are pains in the pelvis at menstruation, and often, between periods, dysuria and defecation troubles. There may be a feeling of discomfort due to the swelling in the vagina. Menstruation goes on by the open part of the tract, but it tends to be irregular.

Physical Signs.—An elastic swelling is found on one side of the vagina. The uterus is enlarged, and lateral distention may be made out in it. Breisky has shown that the lateral hematocolpos may undergo a kind of torsion, the lower end becoming anterior, the upper, posterior.

Differential Diagnosis.—When the atresia is low down, the swelling may be mistaken for a vaginal cyst, a hernia, a pelvic hematoma, or an inflammatory exudate. When situated high, diagnosis may be very difficult, and the condition may be mistaken for a broad ligament or intraperitoneal swelling close to the uterus. Winckel has pointed out that lateral vaginal atresia is also to be differentiated from a condition in which pockets exist on the side of the vagina, due to inversions of the mucosa; they may be an inch or more in length.

If pregnancy take place in the uterus, the difficulty of diagnosis is great, and the condition may easily be mistaken for ectopic gestation. Where there is very great doubt as to the condition, an abdominal exploratory incision may be necessary.

Treatment.—If, with this condition, the Fallopian tube on the corresponding side be at all distended, it should be removed by abdominal section. The atresic vagina should be opened and drained, the septum being cut away. The cervix should then be pulled down with a volsella, and the septum in the uterine cavity removed. Afterward the vagina should be douched daily with an antiseptic lotion.

SEPTATE VAGINA.

This is the condition in which fusion of the two Müllerian ducts has not taken place. Very rarely there may be a double vulva as well. Usually the vulva is single, though the hymen may have two openings. In the majority of cases the two canals are side by side, one of them, usually the left, tending to lie a little in front. Sometimes the septum is somewhat transverse, so that one canal lies somewhat in front of the other. Usually, one canal is a little larger than the other. The septum may extend throughout the whole vagina; it varies in thickness, and may be perforated at spots. In some cases there may be a mere band or a ridge on the wall.

In most cases where the condition is well marked the uterus is septate, bicornute, or diadelphous; it may also be single, communicating with only one vaginal canal. Sometimes it is unicornute, the other horn being rudimentary; in such a case the corresponding vaginal half is rudimentary.

Symptoms.—Sometimes there may be difficulty in coitus, or dyspareunia, but generally the condition is not made out until labor comes on, when it may cause obstruction.

Treatment.—The septum should be excised.

Unilateral Vagina.—This condition is found generally where there is a unicornute uterus. The canal is narrowed, and lies somewhat lateral to the mesial plane.

Abnormal Openings into the Vagina.—The vagina may communicate with the rectum or urethra. Sometimes it may be septate in this condition. Fordyce has described a septate vagina in an infant where each half opened into the urethra, both canals being atresic at their lower ends.

Most instances, however, of communication are due to malformation of the vulva, whereby remains of the cloacal stage or of the urogenital sinus condition are left. Rarely a ureter may open into the vagina.

AFFECTIONS OF THE HYMEN.

Malformations.—These are congenital or acquired. Complete absence has been reported, but must be considered as extremely rare. Gellhorn states that this can occur only when the entire genital tract is absent, found in embryos which cannot survive. Double hymen, one being behind the other, has been described, but is doubtful. In such cases the upper membrane is probably formed of coalesced vaginal ridges. The condition of duplication, in which one hymen is beside the other, is found in cases of double vagina.

Atresia is the most frequent form of malformation. In those cases in which the rest of the genital tract is normal the condition is acquired.

Congenital cases are those in which other malformations are present. Inflammation is the chief cause of the acquired atresia.

Inflammation.—The hymen may be involved in any inflammation starting in the vulva or vagina, or it may be primarily affected.

Rigid Hymen.—This condition may lead to dyspareunia, vaginismus, or may prevent successful coitus. Pregnancy, however, may take place. If it exists during labor, it may obstruct the passage of the child. When it is torn, the laceration may be a bad one, and may go deeply into the vulva or perineum.

Sometimes the hymen is abnormally elastic, and may not tear on coitus or even in labor. In some cases it is unusually vascular, and may lead to considerable hemorrhage when torn in coitus.

Cysts.—These are very rare, and are mostly congenital. They may occur on either surface, most often on the outer. They are usually single, but may be multiple. Their contents vary in character, being watery, gelatinous, serous, fatty, etc. The lining cells may be cuboid, cylindric, or of the pavement type.

Various views are held as to their origin. Ricci has stated that some arise from embryonal epiblastic remains lodged in the stroma. Bastelberger advanced the explanation that some develop from infolding of a part of the surface epithelium which had previously become separated.

Döderlein has stated that the coalescence of hymeneal folds may give rise to cysts. Piering believes that they may arise from distended lymph-spaces. Others hold that they may develop from the glands which are occasionally found in the hymen. These glands may, in some cases, be sebaceous; in others they may be derived from the Wolffian ducts.

Solid tumors have been rarely described, *e. g.*, sarcoma, angioma, simple polyp.

CHAPTER XII.
AFFECTIONS OF THE OVARIES.

ANOMALIES.

Absence.—Both ovaries may be congenitally absent; this is usually associated with absence or with defective development of the uterus itself. One ovary may be wanting; the corresponding tube is usually absent, and



Fig. 187.—*a*, Accessory ovary ($\times 10$); *b*, Graafian follicle ($\times 77$).

sometimes the corresponding horn of the uterus; occasionally, the kidney on the same side.

Ovaries vary considerably in size, sometimes being very small. Rudimentary ovaries may contain few or no Graafian follicles.

The association of this rudimentary condition with imperfect development of the large blood-vessels has been frequently observed, especially in

idiots and cretins. The ovary may be divided by fissures, so that one or more parts may be isolated. The fissures may be either congenital or caused by postnatal inflammation.

Supernumerary ovaries, *i. e.*, small masses of ovarian tissue distinct from the ovary proper, are occasionally found and are generally believed to be congenital anomalies. In some cases the condition is merely the result of fissuring due to the pressure of inflammatory bands, or to the separation of a piece from the main ovary as the result of traction of adhesions or other causes. Small fibromata or fibromyomata may be wrongly described as supernumerary ovaries.

HERNIA OF THE OVARY.

The ovary alone, with or without the tube, uterus, omentum, or intestine, may occupy a hernial sac. The inguinal variety is most frequent, though it occurs but rarely. It may occur on one or both sides. If congenital, it is not usually recognized until the time of puberty, when symptoms develop.

An acquired hernia may occur at any age, and the symptoms produced may be like those of strangulated epiploceles or enteroceles, especially if caused by twisting of the pedicle.

Apart from strangulation, there may be distress or pain in the inguinal region, worse during the menstrual periods, and sensitiveness on pressure. The ovary usually becomes adherent, and often presents various pathologic changes.

Treatment.—The hernia should be reduced by taxis if possible, and failing this, a protecting cap should be placed over it. When the condition causes distress or pain, or if pregnancy is likely to take place, herniotomy should be performed, the ovary being restored to the pelvic cavity if normal, and removed if diseased. Obturator, femoral, sciatic, and abdominal (ventral) hernias are sometimes found.

SINKING OF THE OVARY.

The ovary may be displaced in various directions, especially downward.

Etiology.—A considerable proportion of cases develop after labor, when the conditions are very favorable, the ovary having been enlarged and its ligaments softened, or after inflammatory processes.

A sudden fall or jump or increase of abdominal pressure, *e. g.*, lifting, may cause an ovary to descend if the favoring conditions are present. They may be pushed down by tumors of various kinds. Enlarged tubes which fall usually carry down the ovary, while inflammatory adhesions, retroverted and prolapsed uteri, drag them down. Displaced ovaries frequently become much congested or edematous or even altered by inflammation. They may be found in the following situations: 1. In the pouch of Douglas. 2. Behind the lower parts of the broad ligaments. 3. In the uterovesical pouch. 4. In the cup-shaped depression of an inverted uterus.

The last two are very uncommon.

Diagnosis.—There is pain in the pelvis, increased at the periods, by coitus, and on defecation, and often associated with marked disturbance of health and neurotic complications. The ovaries are usually exquisitely tender to touch, and all the symptoms are aggravated if inflammation is present.

Treatment.—Hot douches, glycerin tampons, and blisters in the iliac regions should be tried, and the bowels carefully regulated. A retroverted uterus, if present, should be replaced, if possible, and retained in position with a Hodge or Albert Smith pessary; if these give rise to pain, a ring may be worn for a time.

When there is no continued benefit from these measures, abdominal section should be recommended in order that the condition of the ovaries may be carefully studied. Removal of one or both is necessary only when extensive pathologic changes are found in them. In most cases it is possible to carry out resection and still leave some normal ovarian tissue. Occasionally not even resection may be necessary.

In order to prevent the ovaries from falling down again the following procedure is advisable: If the uterus be retroverted, the round ligaments should be shortened by doubling them through the broad ligaments under the utero-ovarian ligaments and stitching them to the posterior surface of the uterus (see p. 486).

The infundibulopelvic ligament near the ovary and tube should also be stitched with catgut to the peritoneum of the iliac fossa just above the brim. The resulting adhesions act as a new suspensory ligament and keep the ovaries elevated. It is recommended by some that the mesovarium, when long, should be crumpled with stitches. This is not advisable because of the risk of excessive ovarian congestion.



Fig. 188.—Chronic ovaritis with hematoma. The ovary was very edematous.

HYPEREMIA. HEMORRHAGE.

Hyperemia of the ovary may occur in all conditions which cause congestion in the pelvic viscera, *e. g.*, in menstruation, coitus, and pregnancy, but it may be peculiar to the ovaries in some cases, *e. g.*, early inflammation, varicosity of the ovarian veins, new-growths of the pelvic viscera.

Hemorrhage into the ovary may be found in various forms. Its causes

are numerous. In connection with the escape of an ovum, excessive blood may accumulate in the ripened follicle. Excessive menstruation is believed

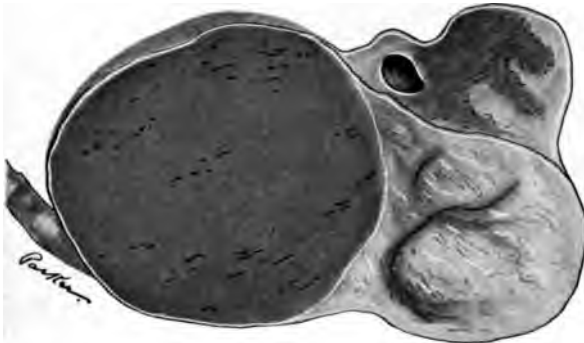


Fig. 189.—Ovary enlarged from chronic ovaritis and containing a large hematoma. The tube was thickened and adherent to the ovary.

to result sometimes in small extravasations of blood in the parenchyma ovarii. They may also follow torsion of the mesovarium, compression of the ovarian vein, or varicosity of the latter. Trauma, *e. g.*, rough examinations and massage, may sometimes be a cause, also local inflammatory conditions and general infections, *e. g.*,

typhus, cholera, influenza, sepsis, etc. It may accompany disturbances of the circulation due to cardiac, renal, and other diseases; also in scorbutus and

phosphorus-poisoning. Rarely, ovarian pregnancy is a cause. The blood may be localized or diffuse, usually the former. Small localized hemorrhages are most frequent in the parenchyma, either in or between the follicles. When the latter are affected, the blood usually accumulates external to the membrana granulosa, pushing it inward, or may break through into the true cavity of the follicle. Multiple small extravasations usually vary from the size of a pin-head to that of a hazel-nut. Sometimes they may run together, forming irregular swellings. Occasionally a hematoma may be one or more inches in diameter. These are usually follicular accumulations which gradually enlarge by fresh hemorrhage. Blood-cysts of the corpus luteum are described on p. 373. Bleeding in an ovarian pregnancy may form a large diffuse hematoma in which fragments of the chorion are found. Hemorrhages are usually absorbed, leaving pigmented scars to mark their site. Where extravasations have been excessive, a considerable portion of the ovary may be permanently injured.

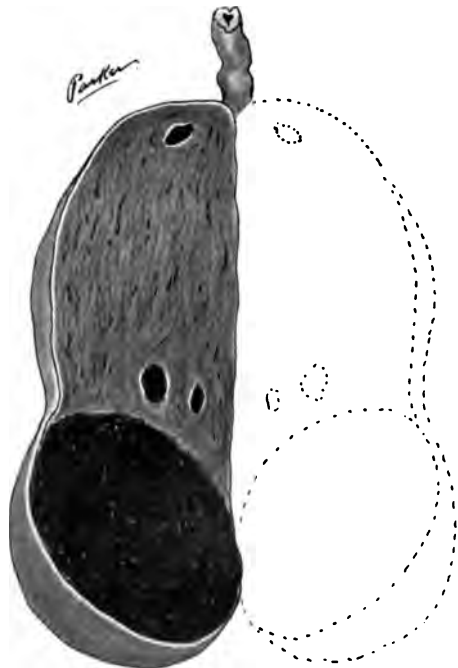


Fig. 190.—Chronic ovaritis with hematoma (longitudinal section).

PLATE III.



This represents an enlarged ovary laid open, a central hematoma being visible.

Sometimes extravasated blood may burst through the ovary into the peritoneal cavity, giving rise to a hemocele. In the great majority of cases ovarian hemorrhages are not recognized clinically, being usually noticed in operations and autopsies. In one case known to the author in which a large ovarian hematoma formed in connection with an ovarian pregnancy the symptoms resembled those caused by intratubal bleeding in tubal gestation.

In cases in which blood escapes free into the peritoneal cavity in any quantity, the well-known signs and symptoms of hemocele are present.

Treatment.—When the condition is accidentally discovered, the ovary need not be interfered with unless the extravasation is extensive. If the blood is localized in one large mass, it may be removed and the cavity closed with fine continuous catgut sutures.

Where the ovary is greatly destroyed, it may be removed. A varicose ovarian vein should be ligated.

INFLAMMATION (OVARITIS; OÖPHORITIS).

Inflammation of the ovary is a very common affection, and may be on one or both sides. Various changes are described in connection with this condition, but their exact pathology is not yet thoroughly understood.

ACUTE OVARITIS.

Etiology.—Various infective conditions, *e. g.*, especially infection following abortion or labors, gonorrhea, pneumonia, mumps, the acute exanthemata, tuberculosis, actinomycosis, etc.

Pathology.—In acute inflammation the ovary becomes enlarged and congested. The tissues are infiltrated with serum, leukocytes escape from vessels, and even blood-extravasations may occur. The entire organ may be involved, or the parenchyma be chiefly affected. The Graafian follicles enlarge, their contents becoming cloudy, the cells of the membrana granulosa and discus proligerus degenerating, and the ovum breaks down. Abscess formation may take place. The germinal epithelium on the surface may degenerate, an exudate may pour out, and adhesions form between the ovary and adjacent viscera.

An ovarian abscess may involve the whole ovary and reach the size of an egg, or more rarely may become several inches in diameter. It may rupture spontaneously into the intestine, bladder, vagina, or through the abdominal wall, improvement in symptoms usually following this occurrence. Rarely, it may rupture into the general peritoneal cavity and cause peritonitis and death. An ovarian abscess may communicate with a pyosalpinx (tubo-ovarian abscess). Other adjacent structures may also be involved by direct extension. Calcareous changes sometimes follow chronic abscess; or, if no abscess forms, the acute process may gradually subside, a chronic inflammatory condition continuing, the ovary either remaining enlarged or later undergoing great shrinkage, becoming atrophied and sclerosed.

Diagnosis.—The symptoms of acute ovaritis due to its proximity to the peritoneum are practically the same as in any localized acute peritonitis (see p. 269). There is pelvic pain, aggravated by movement, defecation, and

pressure. When suppuration occurs in the organ, there are usually chills and marked elevations of temperature. When there is wide-spread peritonitis as well, it is not always possible to determine what other structures are involved. On bimanual examination it may be impossible to palpate the ovary on account of the pain and rigidity of the abdomen. There are usually cutaneous hyperesthesia and reflex contractions of the abdominal muscles. If the ovary is palpable, it is found to be enlarged and exquisitely tender. Its outline is more rounded than that of a distended tube, which latter is usually more elongated in one direction. Yet it is easy to mistake one for the other. A large ovarian abscess wall may be tense and elastic, or fluctuation may sometimes be obtained, especially on the posterior wall, when it is palpated per rectum. It is usually fixed by adhesions.

In the early stages an acute right-sided ovaritis may, like an acute salpingitis, be mistaken for an appendicitis. In the majority of cases the differentiation can be made with certainty only when the diseased ovary can be palpated by vaginal or rectal examination. It must, however, always be remembered that an appendix may lie in the pelvic cavity, and that exudates arising in connection with appendicitis may extend into the pelvis. Also, the appendix and ovary may lie so close together that one may be involved secondary to infection in the other.

Treatment.—The patient should be kept at rest in bed, a coil of circulating ice-cold water being placed over the lower part of the abdomen. The diet should be simple and mainly liquid. The bowels must be kept open with saline aperients. Hypodermatic injections of morphin may be needed to subdue pain. When a large abscess forms, bulging downward laterally or posteriorly, it should be opened and drained through the vagina (see p. 235).

Abdominal or vaginal section for the complete removal of the diseased ovary should not be undertaken during the acute process, on account of the risk of infecting the general peritoneum. Abdominal section in this stage is permissible only if there is evidence of a generalized peritonitis, in order that the primary site of the infection may be removed and the peritoneum flushed and drained (see p. 267).

CHRONIC OVARITIS.

Chronic inflammation of the ovary may be the sequel of an acute attack, such as has been described, or it may develop slowly, with no definite onset. Its progress is often marked by subacute exacerbations.

Etiology.—All the causes which have been mentioned in connection with acute ovaritis. Active congestion, displacements, and twistings are favoring conditions. It is very frequently secondary to infectious processes in the uterus and tubes. It is often associated with fibromyomata of the uterus and large ovarian tumors of the opposite side. Of all the causes, gonorrhea is one of the commonest. It may be secondary to an appendicitis.

Pathology.—The disease is usually bilateral. Adhesions to surrounding structures are frequent. The ovary may be somewhat enlarged. The cortical zone is usually chiefly affected, numbers of enlarged Graafian follicles being present. In many cases the follicles may, by their increase in size, cause atrophy of the stroma between them, and as they become crowded

PLATE IV.



Uterine appendages from a patient who had suffered for years with pelvic pain and neurasthenia. The tubes showed marked interstitial thickening and blending of the fimbriae. The ovaries were in a condition of chronic inflammation with extensive small cystic degeneration.

together, their rounded outlines become irregular. This condition of the ovary has often been described as "*small cystic degeneration*." The cysts usually contain clear fluid, the ovum and discus proligerus having disappeared.

Normal follicles are still to be found in varying numbers in certain cases. Usually they are few, the majority having been destroyed by the inflammatory process.

In the central part and hilum of the ovary thickened vessels are usually found, with their lumen frequently obliterated. Indeed, the entire vessel-wall may in parts be transformed into hyaline material.

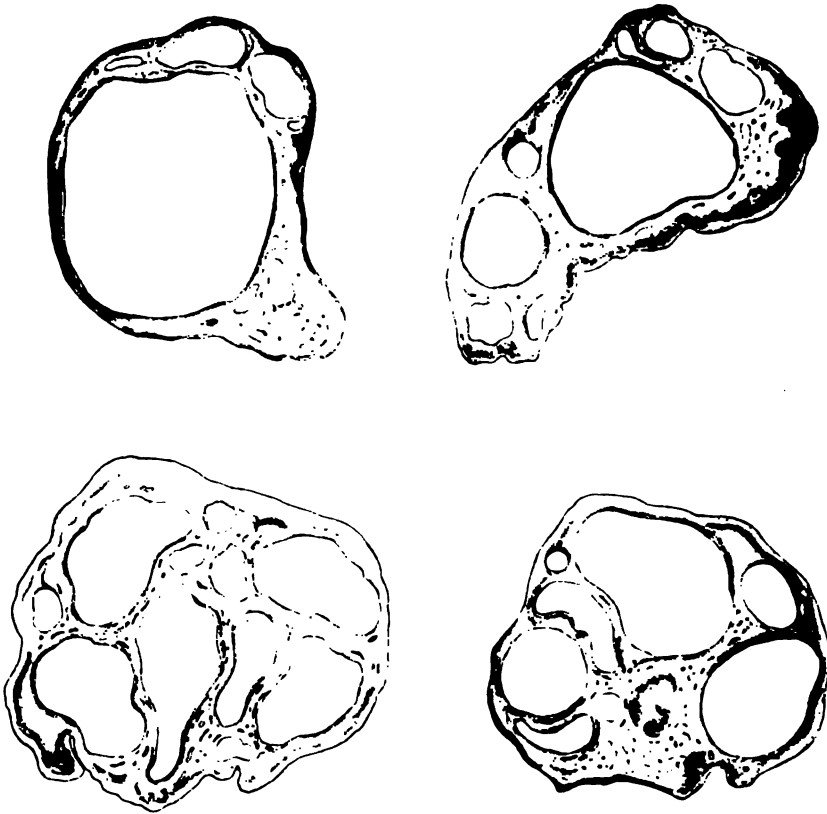


Fig. 191.—Sections of ovaries altered by chronic inflammation and small cystic degeneration (\times about $2\frac{1}{2}$).

In some cases there may be but little follicular enlargement, the changes being chiefly marked in the interfollicular tissue, which becomes sclerosed. In advanced cases the ovary may be small and cirrhotic, the surface being very uneven.

Diagnosis.—The symptoms vary in different cases. Pain in the region of the affected organ is frequent. It may radiate toward the thighs or thorax. There is often increased suffering (dysmenorrhea) as menstruation approaches, also pain during coitus, defecation, or overexertion.

Scanty menstruation may result from marked destruction of ovarian tissue, but menorrhagia or metrorrhagia is frequent. It is not always easy to determine the exact relationship of menstrual disturbances to the ovarian disease because of the frequent coexistence of an endometritis. General disturbances also may exist which affect menstruation. Sterility is often the result of double ovaritis. Chronic ill health and neurotic manifestations are very common.

It is important to note that in many cases the patient may not complain of pelvic distress or pain, but may refer only to abnormal manifestations which are reflexly produced, *e. g.*, headache, nervousness, irritability, digestive disturbances, general weakness, etc.

On making pressure in the iliac regions over the affected organ pain may be produced, but in many cases this does not result. On bimanual examination, especially the recto-vagino-abdominal, the ovary may be palpated, causing increased pain. It may or may not be enlarged, and may be fixed or movable. Frequently irregularities caused by enlarged follicles may be felt per rectum. Shrunken cirrhotic ovaries may often be easily palpated. In all cases in which examination is difficult general anesthesia should be employed. It may be impossible in some cases to distinguish between an ovary and a thickened tube buried in adhesions. A small broad-ligament cyst or a fibroid may easily be mistaken for the ovary.

Treatment.—(a) *Local.*—

Hot vaginal douches (105° to 110° F.) once or twice daily frequently give relief. The application of vaginal tampons soaked in ichthyol glycerin (1:10 or 1:15) is often followed by improvement. The tampons should be inserted in the afternoon and removed the next morning, a hot vaginal douche being taken afterward. The tampons may be introduced every day or every other day for two or three weeks.

A succession of fly-blisters in the iliac regions may have a beneficial influ-



Fig. 192.—Ovary enlarged by chronic inflammation and cystic degeneration. Three small pedunculated cystic masses are present, two being attached to the ovary and one to the tube.

ence. Sometimes it may be advisable to paint the vaginal vault with iodine, daily antiseptic vaginal douches being thereafter given.

(b) *General*.—Careful attention should be given to the patient's habits, occupation, dieting, etc. Careful regulation of the bowels is necessary. Heavy work or exertion of any kind, excessive standing or walking should be forbidden, but the patient must be encouraged to take moderate light exercise in the open air.

Sexual intercourse should be forbidden during treatment, and during menstruation rest in bed is advisable. A change of scene and air is often valuable. Particular attention should be given to combating the nervousness and despondency which are so common in these cases. The patient should be encouraged to practice self-control. Sometimes it is advisable to combine local measures with a "rest cure" in which special feeding and general massage play a prominent part.

Tonic medicines should be given when the health is much run down. Various mild laxatives may be necessary. Iodids and bromids, much employed in the past, have but little value, and are apt to be depressing, but when menstruation is very painful, bromids may be cautiously administered. Treub holds that at least 50 per cent. of cases of salpingo-ovaritis may be cured by conservative (nonoperative) treatment.

In many cases, especially those of long standing, the above-mentioned measures are of little or no avail. Improvement may be noted for a time or there may be no change. Chronic invalidism is apt to develop. After a few months of medical treatment, surgical treatment should be advised. The habit of waiting too long in such cases is most reprehensible, because of the destructive changes which are likely to take place in the diseased ovaries, as well as the firmness of adhesions, making the operation more difficult. The chances of relieving symptoms and at the same time of performing a conservative operation are the greater the earlier the interference.

Surgical Measures.—Great caution must be exercised in the choice of cases and the operative procedures in chronic ovaritis. Within recent years much more conservatism has been observed, and the number of mutilating operations has diminished. This is due to a more accurate knowledge of the pathologic changes in ovarian disease, as well as to the views which have been put forward regarding the influence which the internal secretion of the ovary is believed to exert on the body metabolism. The importance of leaving even a small portion of normal ovarian tissue is now widely advocated.

(a) *Puncture and Destruction of Retention Cysts*.—In cases in which a few small cysts have resulted from inflammation, they may be punctured either with a knife or cautery-point. The latter is preferable, for with it one can destroy the inner lining of the cyst at the same time. The author always turns in the edges of the opening thus made and closes it with fine catgut.

(b) *Cauterization of Raw Areas on the Surface*.—When adhesions are separated from the surface of the ovary, in cases in which it is not intended to remove it, the raw areas should be cauterized so that a black char is formed. As a result of this procedure the ovary is less likely to become adherent again than if the fresh raw areas are left untouched.

(c) *Resection of the Ovary*.—When a large portion of the ovary is dis-

eased, it is very frequently possible to dissect out the diseased part and still leave some normal ovarian tissue. Occasionally, this procedure may be carried out in certain cases through a vaginal incision, but in the great majority of cases it is much more satisfactorily accomplished through the abdominal incision. During the last few years I have employed the latter route entirely, using the following method:

Technic.—The edges of the infundibulopelvic and utero-ovarian ligaments are grasped by forceps close to the ovary and held by an assistant. With a knife a wedge-shaped piece including the diseased portion is removed. The raw surfaces in the ovary are then united with a continuous fine catgut suture. The edges may be approximated by another continuous fine catgut suture, and they should always be inverted where it is possible to do so.

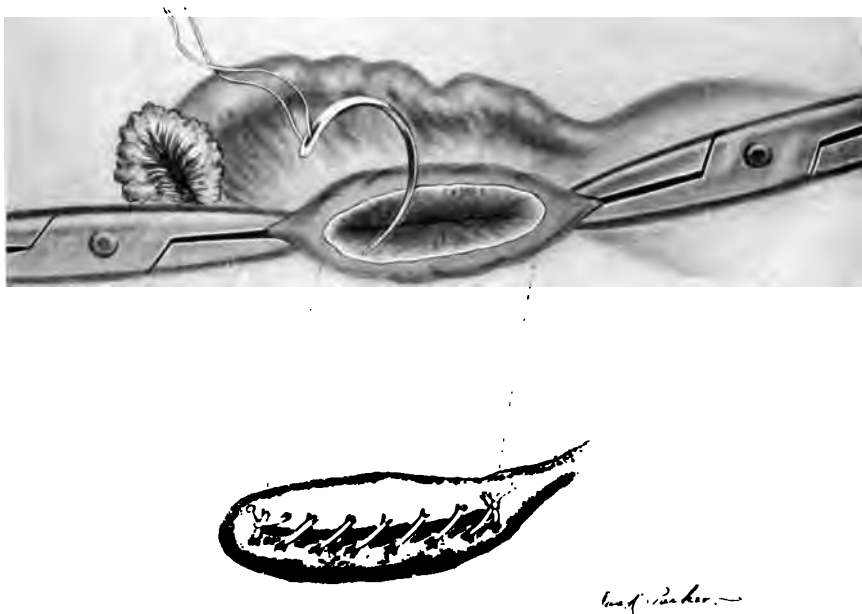


Fig. 193.—Appearance of ovary after resection when the catgut sutures are ready to be introduced. The lower figure shows the raw area closed.

Conservative operations fail in certain cases. In the author's experience in recent years resection has been satisfactory in the great majority of instances. He has been compelled to advise operation a second time for the complete removal of the resected ovary in about 5 per cent. of his cases within a year or more after the first operation, and only in one instance was removal carried out within six months, due to a rapid cystic degeneration forming a tender swelling as large as a hen's egg in the previously resected organ. It must be admitted that it is often impossible with the naked eye to determine accurately the line of demarcation between healthy and diseased ovarian tissue, yet even if a second operation be necessary in a small per-

centage of cases, the record for all cases is more satisfactory than wholesale castration as a first resort.

In about 50 per cent. of the cases in which operation has been carried out a second time adhesions were found attached to the resected ovary.

(d) *Removal of the Entire Ovary.*—This procedure is advisable when the organ is extensively altered by the inflammatory process, *i. e.*, markedly cystic, cirrhotic, or firmly embedded in dense adhesions. The operation may in certain cases be satisfactorily carried out through a vaginal incision, but in the great majority of instances the abdominal route is much more preferable.

Technic.—(1) When there is a long mesovarium. The mesovarium is tied by two catgut ligatures which overlap, and the ovary is cut away external to the latter. The raw stump is then covered with adjacent peritoneum by means of a continuous catgut suture. (2) When there is no mesovarium or a short one. In the majority of cases the ovary is sessile on the broad ligament, and the following procedure should be adopted. The utero-ovarian ligament is firmly ligated between the ovary and uterus with catgut. The ovarian vessels are ligated external to the ovary, and the latter is cut away from the broad ligament. The remaining raw area is then closed with a fine continuous catgut suture.

Result of Removal of the Ovaries.—The views of Curatulo as to the relationship of the ovaries to general metabolism have already been stated (see p. 56).

After their removal there is a diminution in the phosphates eliminated in the urine, and a tendency to corpulence, the body-weight usually increasing. Kruser states that the curve of nitrogen elimination presents a slight oscillation without a distinct tendency to elevation or lowering. The carbonic acid eliminated and the oxygen absorbed diminish considerably for a time and then remain stationary.

Great variations are found in the clinical phenomena following castration. In general it may be stated that they correspond to those occurring at the climacteric. Various workers have used ovarian juice or extract in the treatment of gynecologic troubles as well as after removal of the ovaries and at the climacteric. The results have not been satisfactory.

Kruser states that after ovarian juice injections subcutaneously in cats that have been deprived of their ovaries there is an increase in the phosphates eliminated by the urine. In his experience with women no beneficial results followed the administration in the natural menopause, but he believed that there was some improvement in symptoms after the artificial menopause.

OVARIAN ATROPHY.

Normally, at the menopause, the ovaries become smaller and harder, the outer portion being transformed into a layer of dense fibrous tissue. During sexual life atrophy may also occur, though the conditions inducing it are not well understood. In some cases this may be due to pressure outside the organ, *c. g.*, that caused by dense adhesions or by a tumor. It may also result from inflammatory changes. The pressure of multiple small cysts in the parenchyma always causes more or less atrophy of the true ovarian tissue.

The change is stated to occur in connection with various diseased conditions, *e. g.*, the exanthemata, excessive obesity, marked anemia, diabetes, myxedema, Basedow's disease, akromegaly, morphinism, etc., but accurate information as to the true causative factors is very deficient. As regards the various infectious diseases, it is highly probable that the atrophy of the parenchyma may be due to the influence of circulating toxins or micro-organisms, with or without the accompaniment of any definite inflammatory process. Congenital smallness of the ovaries has already been mentioned (p. 361), as well as its frequent association with aplasia of the large trunk blood-vessels.

On microscopic study of an atrophied ovary there is found to be great reduction in the number of normal Graafian follicles. Indeed, these may be entirely absent. Distended follicles may, however, be found. Apart from these, the organ consists of dense connective tissue.

Symptoms.—Atrophy of both ovaries may be associated with absence of menstruation or with scanty or irregular discharges of blood. There is usually sterility. In some cases there is pelvic pain at or between the periods. Neuroses of various kinds are frequent.

Treatment.—Apart from measures calculated to improve the general health, little can be done. When there is intense pelvic pain, the question of removal must be considered.

CIRRHOSIS.

The transformation of the ovaries into hard, shriveled masses consisting of dense fibrous tissue in which no Graafian follicles or only a few may be found has already been noted in connection with inflammatory processes. In many cases, however, there is no history of inflammation, the etiology being obscure. The condition is usually associated with shrinkage of the ovary. Its relation to health is practically that which has been described with ovarian atrophy. It occurs normally after the menopause.

HYPERTROPHY AND HYPERPLASIA.

Enlargement of the ovary associated with inflammation has already been described. Excessive size of the normal organ may sometimes be congenital. Chronic venous congestion may lead to an increase in size.

Enlargement is very frequently found with large fibroids. Occasionally, in such cases, the ovarian tissue appears to be normal, but frequently distended follicles are present as well as changes in the interfollicular tissue.

CYSTS.

Simple or Retention Cysts.—These are of frequent occurrence. They arise in connection with the Graafian follicles or with the corpus luteum.

(a) *Follicular Cysts, Hydrops Folliculi, Follicular Hypertrophy, Small Cystic Degeneration.*—Enlargements of Graafian follicles giving rise to cysts, which vary in number and size, are very common. The explanation of their formation is not in all cases certain. Nagel has urged that many of these cysts which are described as pathologic are only physiologic enlargements of normal follicles. The majority of investigators, however, explain their occur-

rence as associated with chronic inflammatory changes in the ovary. While it is certain that in some cases small cysts may be found in women who apparently enjoy perfect health, it is equally certain that in many instances their presence may be the cause of marked symptoms, local or reflex.

Their development in connection with ovaritis and the formation of pseudomembranes on the surface is well established, also thickening or hardening of the tunica albuginea and interfollicular tissue, preventing the rupture of the enlarging follicles. These cysts may continue to increase in size if serous fluid be poured into them as the result of surrounding hyperemia, but when the tunica fibrosa folliculi does not yield, the cysts may remain small. Consequently, great variations are found on making sections of cystic ovaries. In some cases the ovum may still be found in the distended follicle, but generally it has disappeared. The cysts frequently form projections on the surface, which may be seen or felt, but in other cases the enlargement may be entirely within the substance of the ovary, while in others still a single cyst may form a projection on the surface a half an inch or more, or, indeed, rarely as much as two or three inches in diameter. When several cysts exist, they may so press upon one another as to assume various irregular shapes, varying greatly from their normal rounded outline. The partition walls separating two cysts may become thinned or even more or less obliterated, so that a communication is established, or several cysts become, as it were, one cavity. The inner wall of a cyst is usually covered with low cubic or somewhat flattened cells, which in places may be absent, or transformed by granular fatty or hyaline degeneration; and external to the epithelium is a connective-tissue layer. The fluid is usually thin, serous, clear, and light-colored, though it may be turbid and sometimes brownish. Degenerated epithelium, fat-drops, blood-corpuscles, and crystals of cholesterin may occasionally be found. The specific gravity of the contents varies usually between 1005 and 1026.

In cases of well-marked cystic degeneration the ovary may, on section, somewhat resemble a small sponge. Normal small Graafian follicles may be absent or scanty. The interfollicular tissue has largely atrophied through pressure. Many vessels have been obliterated, some of which have been replaced by streaks of hyaline degeneration. Here and there numbers of leukocytes may be found.

(b) *Corpus Luteum Cysts*.—After the escape of an ovum from the follicle the latter may be the seat of a cystic formation, first accurately described by Rokitsansky. These cysts are usually single, though sometimes two may be present. They grow slowly, and are rarely more than an inch in diameter, though they may sometimes be larger.

The wall is thick and consists of two layers. The inner or lutein layer is



Fig. 194.—Graafian follicle cyst-wall
($\times 205$).

usually somewhat folded and of a yellow or orange-brown color; the outer is connective tissue and is derived from the tunica fibrosa.

The lutein layer varies in appearance. It has often the characteristic structure of the corpus luteum, consisting of large epithelioid cells in a delicate vascular connective-tissue stroma. Sometimes the epithelioid cells are absent, the layer consisting of connective tissue. Occasionally, as Orthmann and L. Fraenkel have shown, there may be a regular layer of cubic or columnar cells next the cyst cavity; sometimes even rows of cells may be arranged like squamous epithelium. The cyst-fluid is usually clear and serous, though it may be turbid and somewhat dark.

The formation of these cysts is not well understood; it is widely believed that they may result from chronic hyperemia or inflammation in the ovary, though in some cases they follow hematomata of the corpus luteum (see p. 364).

Lockyer has drawn attention to the occasional displacement of lutein cells in the ovarian stroma, in masses or separate from one another. Small cysts may develop from these, owing to breaking down of fused cells.

Diagnosis.—In some cases cysts are discovered only in the course of abdominal operations, not having caused any symptoms. Frequently, however, they are diagnosed on careful bimanual examination, especially when one finger is introduced into the rectum. The ovary may be felt to be enlarged regularly or irregularly. When the cysts form multiple projections, these may often be readily distinguished. Frequently, however, the most careful physical examination may fail to determine the presence of cysts, and, indeed, must not be depended upon, for on opening the abdomen the most extensive cystic degeneration may be found, without either marked irregularity or enlargement of the ovary.

In cases which are associated with symptoms the latter may be few or many, and may be referred to the pelvis or to distant parts. They are practically the same as have been described in connection with chronic ovaritis (see p. 364).

It is highly probable that the symptoms are mainly due to two factors, viz., tension and altered internal ovarian secretion. Very little attention has been given to the latter factor, yet it is not unreasonable to suppose that many of the disturbances which are classed as "reflex" may be due to the influence of an abnormal ovarian secretion.

Treatment.—See "Chronic Ovaritis" (p. 368).

Tubo-ovarian Cysts.—Cystic distentions involving both the tube and ovary may occasionally be found. They have different modes of origin. An ovarian cyst or abscess may rupture into an adherent tube, while the latter is either normal or distended. A hydrosalpinx or pyosalpinx when adherent may burst into a cyst of the ovary. Sometimes the fimbriated end, adherent to the ovary, may become so stretched that the latter may form part of the abscess cavity. A papillomatous cystoma of the ovary may communicate with a distended tube, the wall of the latter being perforated by the papillary growths. Similarly, in carcinoma of the ovary a communication may arise. A distended tube adherent to a growing ovarian cystoma may communicate with the latter by perforation of the intervening tissue.

Tubo-ovarian cysts may be unilateral or bilateral. They range from a very small size to swellings three or more inches in diameter, and are usually

unilocular. The inner lining varies according to whether the tubal or ovarian portion is examined, as well as according to the conditions which are present in the component portions. The communication between the tube and ovary varies. Sometimes it is marked by a thin, valve-like partition. The cyst-fluid varies in appearance: it may be clear, mucoserous, or may be turbid, orange, brownish, or darker colored.

NEOPLASMS.

New-growths of the ovary arise either in connection with epithelial or connective-tissue elements, those developing from the former being by far the most numerous. They may be either solid or cystic, the former being rare.

CYSTOMATA (PROLIFERATING CYSTS).

Ordinarily these neoplasms have been described in two varieties, viz., the proliferating glandular and the proliferating papillary cysts, the latter containing papillary growths. Abel regards these growths as adenomata whose

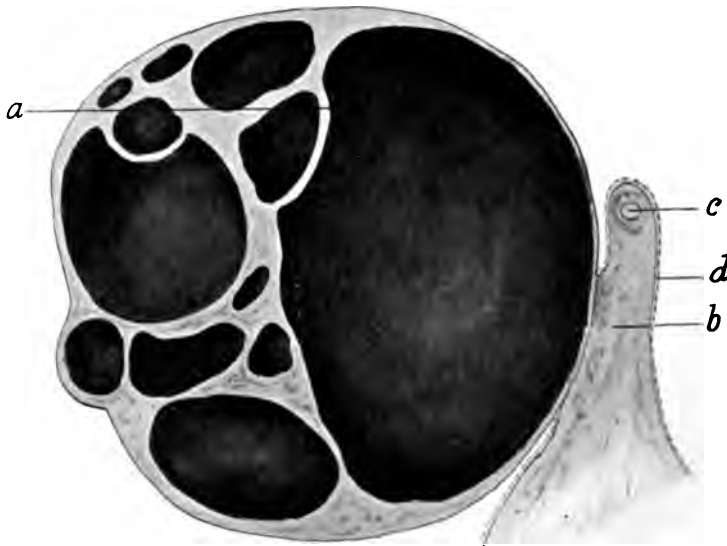


Fig. 195.—Diagram illustrating relationship of an ordinary multilocular ovarian cyst to the broad ligament: *a*, Cyst; *b*, broad ligament; *c*, Fallopian tube; *d*, peritoneum.

epithelial cells are able to produce large quantities of fluid, and, therefore, describes them as cystadenomata, those with smooth inner walls being termed *simple cystadenomata* and those with polypoid growths *papillary cystadenomata*. Recently Pfannenstiel has proposed to differentiate cystomata according to the chemic constitution of their contents. He found that a large number contained a substance formerly termed paralbumin or metalbumin, but shown by Hammarsten to resemble mucin rather than albumin, and termed by him *pseudomucin*. In a smaller number of cases Pfannenstiel found this sub-

stance to be wanting. He also found a difference in their structure, the lining epithelium in the former class being cylindric and resembling mucus-cells, that in the latter class being ciliated columnar epithelium. In the first group the cystic fluid was found to be more or less thick, often colloid, and usually turbid; in the other group it was usually clear, thin, and serous. Pfannenstiël has, therefore, classified ovarian cysts into: 1. Pseudomucinous. 2. Serous. This classification is here adopted.

Pseudomucinous Cysts.—The great majority of ovarian cystomata belong to this group. They may occur at any time from puberty to advanced age, but

are most common between thirty and forty-five. It is generally believed that they are relatively more frequent in unmarried and sterile women. Cystomata vary greatly in size and structure, sometimes being of enormous dimensions. Cartledge has reported a case in which the fluid weighed 240 pounds and the sac 5 pounds. These tumors are made up of numerous cysts. The smaller the tumor, the more alike in size are the cysts, but as they increase in size some cysts develop more rapidly than others; especially is this true of those situated anteriorly, often two or more



Fig. 196.—Section across a multilocular ovarian cystoma.

cysts reaching a very large size. In some large tumors no special enlargement of any one or more cysts occurs, all the cavities remaining small, and on section of the mass somewhat resembling a honeycomb.

When large and small cysts exist together, the latter are often found in the walls of the former, and may form projections either on the outside or inside; indeed, they may sometimes develop rapidly and tend to obliterate the large cavities. Again, several cavities may be joined into one, by pressure atrophy and obliteration of the intervening septa. It is by this process that very large

cavities are produced and occasionally a unilocular cyst may be brought about in this manner, the remains of the septa being marked by slight ridges or elevations on its inner walls.

Large tumors are usually more elastic than small ones. The walls of the individual cysts vary greatly in thickness, and, indeed, in different parts of the same cyst-wall. The outer walls are usually the thickest, being of a dulled, whitish-gray appearance, or when very thin, having a bluish tinge, and not so glistening as a peritoneal surface. These tumors are pedunculated, the pedicle being composed of broad ligament, Fallopian tube, and ovarian ligament.

Structure.—The outer surface is covered with low cubic or flattened epithelium, the remains of the germinal epithelium. The main mass of the wall is fibrous, and may be arranged in one, two, or three layers. Near the pedicle smooth muscular fibers are found. The inner wall of the cysts is covered with cylindric cells, resembling somewhat mucus-cells; their structure is exhibited after



Fig. 197.—Section of small multilocular ovarian cystoma.

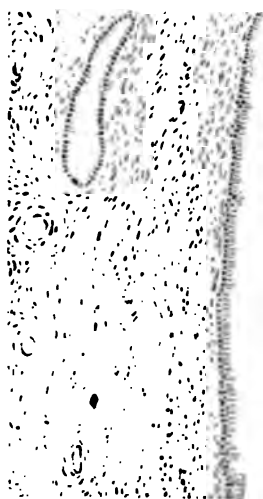


Fig. 198.—Pseudo-mucinous cyst-wall (ovarian) ($\times 96$).

double staining with hematoxylin and eosin. The nuclei are small and basal, the cell-body being clear and transparent. The cells vary in height according to the amount of pressure on them. Here and there small gland-like depressions may be seen extending outward from the epithelial layer in the connective tissue. Portions of these may become snared off by the constriction of the fibrous tissue and give rise to new cysts.

When papillary projections are present, the connective-tissue stroma is often thin and very vascular, but in some cases it may be abundant. They vary in shape and may be warty or dendriform. Rarely, the connective tissue in these swellings may be myxomatous or sarcomatous.

Certain changes may occur in the walls. Calcification takes place sometimes as a deposition in the form of granules or plates. It is the more apt to occur as the nutrition of the tumor is affected, *e. g.*, after slow torsion. Sometimes it may occur in the epithelium or in the cyst contents.

Fatty degeneration is common, especially in the epithelium lining the cysts; it may also occur in the walls, especially in the septa. This change is favored by impaired nutrition. Atheromatous changes may also be found, and infarcts sometimes occur.

The contents of these tumors vary considerably. It is generally viscid, ropy, glairy, gelatinous, or colloid. The specific gravity varies from 1010 to 1030. Often as the cysts grow very large their fluid becomes thinner, while in the smaller cysts it is often very tough and gelatinous and removed with difficulty from the wall. Sometimes the partitions between the number of these small masses may degenerate, and large portions of the gelatinous substance may show the remains of these as whitish lines running through it. Sometimes altered blood may be mixed with the contents; in certain conditions pus may be present also.

The chemic reaction is neutral or alkaline. The solids vary from 50 to 100 parts in 1000, and consist of proteids, fats, and salts; sodium chlorid is the most abundant salt; alkaline and earthy phosphates are also found. Cholesterin is sometimes present. Other salts, *e. g.*, leucin, urea, cystin, allantoin, are sometimes found.



Fig. 199.—Ovarian cystoma developing from the outer end of the ovary and extending within the broad ligament.

Pseudomucin, the characteristic constituent, varies in amount. It is most abundant in small cysts with colloid contents. This substance is a glycoprotein and differs from mucin in not being precipitated by acetic acid. When boiled in the presence of dilute mineral acid, it sets free a copper-reducing substance.

Pjannenstiel's Test for Pseudomucin.—Add to a quantity of cyst-contents twice the volume of alcohol, and mix well. Filter the precipitate and wash it with alcohol, and then gently press between filter-paper to remove the excess of alcohol. Boil a portion of the precipitate thirty minutes in a 10 per cent. solution of hydrochloric acid. After cooling add phosphotungstic acid until the albumin is entirely precipitated. Filter the filtrate and then use the Trommer-Fehling test for sugar. If reduction takes place, pseudomucin is present.

Epithelial cells, more or less degenerated, may be found in the fluid, granular masses, blood-corpuscles, granules of pigment, leukocytes, pus-cells, cholesterin. There are no pathognomonic cells.

Racemose Ovarian Cyst.—This is a rare form of multilocular cyst, first mentioned by Koeberlé in 1878. In 1903 Jayle and Bender were able to collect 17 cases besides one described by themselves. Tumors of various sizes have been noted. The growth consists of a mass of vesicles, varying in diameter. In a specimen described by Hellier and Smith the largest vesicle contained more than 200 c.c. of fluid, the smallest only a few cubic centimeters. The fluid is a limpid, yellowish fluid, containing a trace of albumin and chlorids. The wall of each vesicle is usually thin and somewhat translucent. It is lined by a single layer of cells, the latter being columnar, cubic, or flattened. In some instances cilia have been noted. Jayle and Bender consider that the

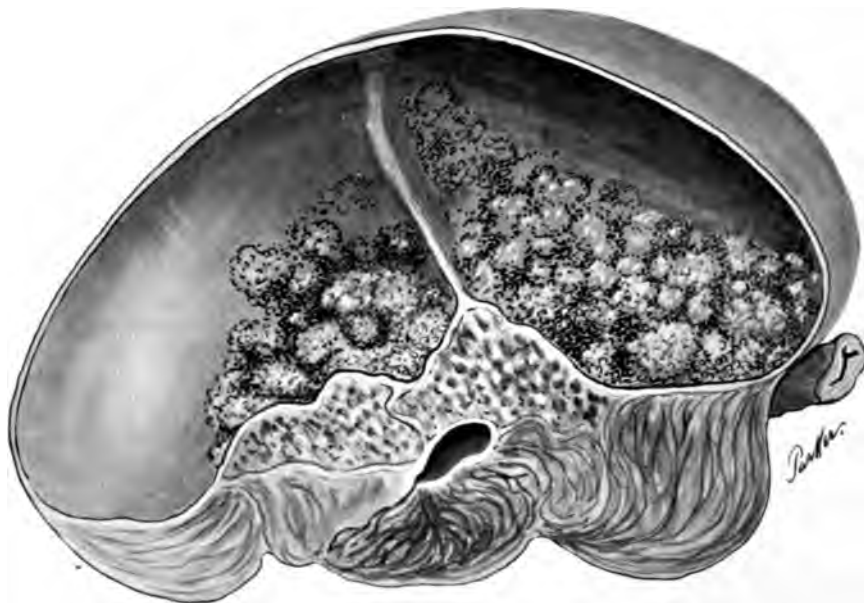


Fig. 200.—Section across a papillomatous ovarian cystoma.

vesicles are derived from the surface germ-epithelium of the ovary and not from Graafian follicles. In Hellier and Smith's case the tumor was attached to the ovary by a pedicle.

Serous Cysts.—These are much less common than pseudomucinous cysts, occurring in the proportion of about 1 to 8 of the latter. They are more frequently bilateral, and usually do not reach the large size of the pseudomucinous cysts. They may, however, occasionally form swellings ten or twelve inches in diameter. They frequently tend to grow into the broad ligament.

Externally, the cyst closely resembles the pseudomucinous cyst. They are mostly multilocular, the number of cavities being smaller on the average than in the pseudomucinous cyst. Frequently only one large cavity is found, but in such cases, on careful study of the tumor-wall, small cysts may usually be

found; in it also frequently in places there may still be found some normal ovarian tissue. In the great majority of instances papillary or papillomatous growths are found on the interior of the cysts, but occasionally they are absent.

Papillary growths vary in appearance. They may be arranged as densely massed nodules or as detached branching nodules, from the size of a pea to that of a nut, rising from a pedicle. They vary in color from white to red; sometimes they are hard from calcareous deposits, which may be concentrically arranged (psammoma).

The larger a cyst, the smaller the proportion of papillomatous growths it is apt to contain. Some small cysts may be entirely filled with them.

The tumors tend to grow between the layers of the broad ligament and therefore to be covered with peritoneum. The uterus is displaced by the

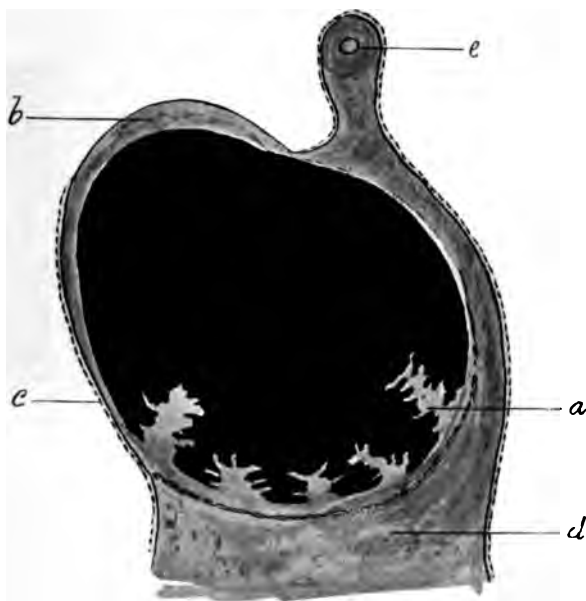


Fig. 201.—Papillomatous ovarian cyst developing within the broad ligament: *a*, Papillomatous projection on inner surface of cyst; *b*, solid ovarian tissue; *c*, peritoneum; *d*, broad ligament; *e*, Fallopian tube.

growth, which can develop underneath the peritoneum of the pelvic floor, or in the mesentery of the sigmoid flexure or intestines. It may also come into direct relationship with the bladder or abdominal wall. Adhesions are frequent.

✂ In cases in which the tumor does not grow extraperitoneally, it is pedunculated like the ordinary cyst. The main mass of the tumor-wall is fibrous tissue. The epithelial inner lining is chiefly columnar, and for the most part ciliated, the cells varying greatly in height, and in many parts being cubic. The

papillomata are usually covered with cylindric cells, papillomatous growths being often found on the surface of the cyst, as well as within the cavity. They may arise independently or may spread from the interior.

The stroma of the projections is delicate connective tissue. They are vascular, and bleed easily. Calcareous concretions are apt to develop in the stroma of the wall and in the papillæ. As the papillomata grow, they may perforate the walls of the cysts and extend into neighboring cavities, and also the outer cyst-wall, and fasten the tumor to the adjacent organs, etc., *e. g.*, pelvic floor, uterus, rectum, bladder; or rupture may occur into the free peritoneal cavity and dissemination take place quickly, the tumor-cells continuing their growth on the free peritoneal surface or gradually extending

into other organs. Ascites accompanies the development of these tumors as well as the secondary masses.

The pouch of Douglas, the omentum, and mesentery are most abundantly covered with the growths after rupture. These tumors usually contain clear, thin, straw-colored or greenish fluid, without any gelatinous or colloid character. It is rich in albumin, but contains no pseudomucin. It may sometimes be opaque. Free portions of the growths may be found in the fluid.

Histogenesis.—Various views have been advanced to explain the growth of ovarian cystomata. It has long been held that they arise from Graafian follicles, especially the young undeveloped ones. Virchow thought that colloid cysts resulted from colloid degeneration of the ovarian stroma. Many have believed that the so-called Pflueger's tubes of embryonic epithelium give origin



Fig. 202.—Outer surface of ovarian cystoma showing large area of papillomatous growths.

to cysts. In recent times it has been thought that they may develop from invaginations of portions of the surface germinal epithelium, which undergo pathologic changes. Recent researches seem to show that the membrana granulosa of the Graafian follicles may undoubtedly be the starting-point of cystic growths. Pfannenstiel believes that pseudomucinous cysts usually arise in this way. With regard to papillary cysts, it has long been held that they arise from Wolffian remains in the hilum of the ovary. Pfannenstiel, however, states that they generally arise from altered germinal epithelium, while von Velits thinks that they originate in the Graafian follicle. Williams believes that they usually start in the Graafian follicle and that the germinal epithelium is perhaps the most frequent source of superficial and multilocular papillary cysts.

Marchand is of opinion that these ciliated cysts may originate from tubal epithelium, being, therefore, Muellerian.

Metastasis.—Occasionally, *pseudomucinous cysts* may be accompanied by small independent gelatinous masses on the parietal or visceral peritoneum. These were formerly described as myxoma peritonei, more recently as pseudomyxoma. They are probably formed by the escape of the gelatinous or colloid fluid from the cyst, adhering to the peritoneum, which becomes congested at the point of attachment. In the removal of such cysts care must be taken to prevent the escape of the fluid in order that such masses may not form.

The *serous papillary cyst* is more apt to form true metastases if the cyst-wall is perforated or ruptured. A wide area of the peritoneum may thus be covered with cauliflower growths, accompanied by ascites.

These secondary growths are often regarded by operators as necessarily malignant. That they are not has been clearly demonstrated by various workers, notably by Pozzi. After the removal of the primary ovarian tumor, complete recovery may occur, sometimes with, sometimes without, recurrent ascites. In some cases, undoubtedly, they may take on a malignant development.

Malignancy.—Both varieties of cysts may occasionally be the seat of malignant disease, either carcinoma or sarcoma, the latter being very rare.

Embryomata.—Under this heading may be described certain solid and cystic growths in the ovary which contain tissues derived from embryonal layers which do not normally enter into the formation of the ovary. Embryomata are most frequently cystic (dermoid cysts), but occasionally are entirely



Fig. 203.—Papillomatous cyst of ovary ($\times 49\frac{1}{2}$).

or almost entirely solid (teratomata). There is no qualitative difference between these varieties, and various transitional forms may be described. Dermoids are the least frequent of ovarian cysts, forming about 3.5 per cent. of all cases, according to Olshausen. They may grow to be as large as an adult head, but ordinarily they are met smaller than this. As a rule, they are unilateral, but they may be found in both ovaries. They are almost always unilocular, though occasionally several smaller dermoid cysts may be found in the tumor-wall. They rarely develop within the broad ligament. The walls are often thick, but may be thin. The inner surface may be smooth in large part, with projecting, skin-like portions on which hair grows; it consists of stratified squamous epithelium. In some cases the structure of a mucous membrane may be found, columnar epithelium and mucous glands being present. The main portion of the wall consists of connective tissue in which adipose tissue may be found.

Bones and teeth are not constant constituents. The former are situated in the connective tissue of the wall; sometimes the pieces of bone are connected by joints. Teeth generally lie in the connective tissue, but may project into the cavity of a dermoid; they are usually irregular, and represent mostly incisors and molars; sometimes they are fixed in bony plates. The crowns tend to slope toward the median plane of the body. Occasionally a milk-tooth may be found in course of absorption, another growing beneath it. Gray matter of the central nervous system has been found; rarely, medullated nerves. Sometimes nerves can be traced from the gray matter to bone and other tissues. Smooth muscle-fibers have been noted.

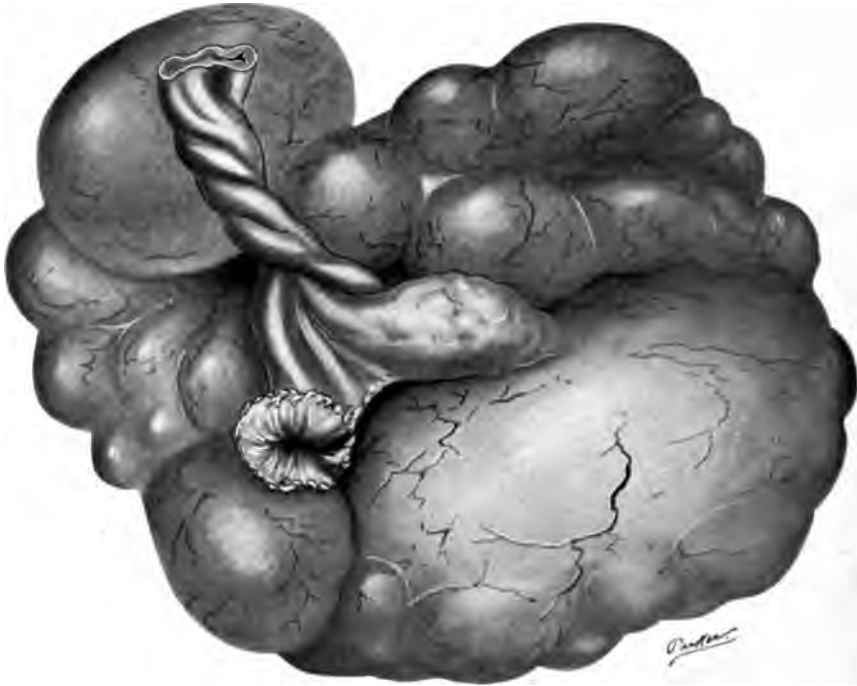


Fig. 204.—Multilocular ovarian cyst with pedicle somewhat twisted.

Nail is very rarely found. Hair is often of great length. It may be white in elderly people. It tends to be shed and to lie in the cavity.

The sebaceous glands may give rise to sebaceous cysts, and "horns" may grow from the skin. Nipple-like projections are occasionally found, sometimes surrounded with an areola. Rarely these may be associated with small mammæ, which may produce colostrum.

Thyroid gland tissue has also been found. In one case described by Glocker the teratoma consisted almost entirely of this structure.

The dermoid usually contains a thick, oily material containing fat, epidermic cells, hairs, and sometimes cholesterolin. On removal from the body the fat hardens. In it are sometimes found "epithelial pearls" formed of shed masses of concentrically arranged epithelial cells.

When mucous membrane lines a cyst, it may secrete mucus. Some dermoids may contain no fluid at all. There may be retention cysts derived from sweat-glands. Sometimes colloid degeneration is found in the stroma.

An embryoma and a proliferating cystoma, usually of the pseudomucinous variety, may coexist in the same ovary. It may also be associated with a malignant growth, either sarcoma or carcinoma, the latter being epidermal in origin. Recently Yamigiva found a glandular cancer which he believed to have started in a rudimentary mamma. If a dermoid ruptures, there may result epidermal implantation on different parts of the peritoneum. It is generally believed there is some special tendency to malignancy in dermoids, but this has not been definitely established. Sarcomatous degeneration is most frequently found. Jung doubts the occurrence of cancerous changes.

Doran states that he has frequently observed the growth of malignant tumors in the abdomen after removal of dermoids.

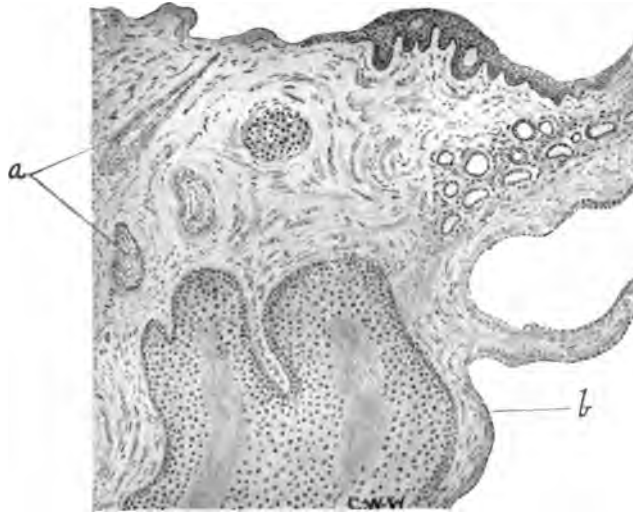


Fig. 205.—Dermoid of ovary: *a*, Hair-follicle; *b*, lining of cyst ($\times 40\frac{1}{2}$).

Development and Growth of Embryomata.—They are the most frequent tumors in the abdomen before puberty, and may be met in early childhood. The majority are recognized, however, after puberty, but they may not be found until very old age. They usually grow very slightly in the course of years. At puberty the most rapid increase occurs in them. Sometimes the genitals are imperfectly developed in the case of a dermoid of the ovary, but occasionally premature development is marked.

Peritonitis and adhesions are very prone to occur around embryomata, and torsion of the pedicle is common. Suppuration, gangrene, and rupture of the wall may take place.

In many cases only slight pressure disturbances are produced. Marked enlargement may be due to colloid degeneration, to retention cysts, or to the growth of an accompanying proliferating cystoma.

Theories as to the Origin of Embryomata.—Some believe that early in fetal life certain portions of the fetal layers, especially the epiblast, are included in the developing ovary. While the main part is epiblastic, it is likely that mesoblastic elements are also included, helping to explain the development of bone and muscle.

Others, *e. g.*, Waldeyer, think that the epithelial elements in the ovary may in these cases have some special formative power, producing elements other than epithelium. (As Olshausen points out, if this be the case, the production of such a varied assortment of elements might deserve the name of a "parthenogenetic development.")

Bland Sutton thinks that "the epithelium of the ovarian follicle is the source of all the structures found in ovarian dermoids." He makes a sharp distinction between dermoids and teratomata, the latter being due to suppressed embryos.

Olshausen, on the other hand, thinks that the development of teratomata in the ovary is due to fetal inclusion, and that there is no practical genetic distinction between ovarian dermoids and teratomata.

(It is important to note that an old tubal pregnancy which has undergone lithopedion formation, and with which the ovary has been closely blended, has often been wrongly described as either a teratoma or a dermoid.)

Pick has described a hydatidiform-mole-like condition in a dermoid cyst. The statement of Marchand and Bonner that in these tumors no trace of fetal membranes can be found does not, therefore, hold true. Schlagenhauser and others have found derivatives of the membranes in teratomata of the testis, both chorio-epithelioma and hydatidiform-mole-like structure. Pick considers their presence in the ovarian dermoid no proof of the origin of the latter from fertilized polar bodies, nor their absence any proof of their origin from displaced blastomeres.

The difference between ordinary hydatidiform mole and that found in a dermoid is only that the former are younger than the patient in whom they are found, the latter being of the same generation as the patient.

Bland Sutton has pointed out that "in women dermoids have never been found growing primarily from any other abdominal viscus save the ovary."

Wilms insists upon the ovulogenous origin of ovarian dermoids, which are different from dermoids developing in the head, thorax, and other parts of the body. The former are characterized by having tissues derived from the three primordial germinal layers, ectoderm, mesoderm, and endoderm, the order in which they are produced corresponding to that found in the normal development of the embryo, the ectodermal derivatives being most conspicuous and the endodermal least marked.

Pfannenstiel and Kroemer believe in the ovulogenous origin, the former stating that while the "embryoma" or actively growing portion is derived from the ovum, the cystic portion of the tumor is derived from the wall of the Graafian follicle.

Neck and Nauwerck state that Wilms' view is wrong, holding that Bonner has shown it to be impossible on embryologic grounds. They state that there is no parallelism between the evolution of dermoids and that of the embryo. Traina has shown experimentally that a piece of embryonal skin implanted into the ovarian tissue of a guinea-pig always gives rise to a cyst within which

it is found inclosed, the change being probably due, according to Neck and Nauwerck, to the activity of cells of the grafted tissue. These workers think that dermoids arise independently of the follicles, and are not a mere aberration of embryonal development. There is probably some form of displacement of the blastomeres similar to what takes place in other parts of the body.

Various Changes in Ovarian Cysts.—*Torsion.*—Rotation of the cyst may occur, causing a twist in the pedicle. This takes place in varying degrees, *e. g.*, half a turn may be found, or as many as five or six turns. The causes are not well known. They are said to be, the influence of a growing pregnant uterus; emptying of the pregnant uterus; sudden alterations of intra-abdominal pressure, *e. g.*, lifting, unequal growth of the tumor, movements resulting from a physical examination.

Predisposing factors are ascites and a long pedicle. Dermoids are peculiarly liable to torsion, especially when bilateral. Torsion interferes with the nutrition of the tumor, and various results follow.

Edema of the pedicle and tumor occurs, marked venous engorgement, hemorrhage into the cyst-wall or cavities, which may cause great anemia or death; peritonitis, leading to adhesions with surrounding structures; if the arterial circulation is shut off, necrosis and gangrene of the cyst.

Where gangrene does not occur, the tumor may shrink in size. Sometimes, even though the pedicle be completely divided, and the veins thrombose and the tissues are brittle and tend to be easily severed, yet the tumor may continue to be nourished by means of the circulation carried on through adhesions, especially those of the omentum. It is doubtful if it can increase much in size in this condition. The tumors which have been most frequently observed undergoing this change are dermoids. Sometimes the intestine may be obstructed (ileus) by a torsioned tumor.

Inflammation.—Adhesions are comparatively common in ovarian tumors. These may possibly be due to mechanic irritation of the peritoneum by the tumor, but they often follow infection through the Fallopian tube, vermiform appendix, or adherent intestine.

Lewis and Le Conte have described two cases of infection of ovarian cysts during typhoid fever and have collected seven other similar published cases. Previously cases had been reported of suppurating cysts in which an antecedent attack of typhoid had been noted. In their cases operation was carried out within a few weeks of the beginning of the fever and a relapse in the latter followed.

Tapping was a frequent source in the preantiseptic days. Adhesions may form between the tumor and the parietal or the visceral peritoneum. They are common when the pedicle of a cyst is twisted. The larger the cyst, the more likely there are to be adhesions. Those of the abdominal wall are the most frequent and extensive, owing to the more constant pressure there. Next in frequency are omental adhesions, then intestinal, then vesical, uterine, etc. The condition of the case is thereby rendered much worse as regards operative treatment, for during the operation for removal there may be great risk of tearing through a large vessel, *e. g.*, the iliac, or through the ureter, vermiform appendix, intestine, etc.

Suppuration may occur in some of these cases. Sometimes the pus may escape to the exterior by ulceration through into the lumen of an adherent

viscus. Gas may develop in the cyst in connection with suppuration, especially following infection from an adherent intestine, giving rise to a tympanitic note on percussion, also to the succussion sign.

Rupture.—Rupture of an ovarian cyst may occasionally occur. The causes vary. The wall may become very thin at one place and gradually burst, or the thinness may be due to the development of secondary cysts in the main wall. In such cases there may be several points of perforation. Hemorrhage in the wall or in the cyst may lead to rupture. Thrombosis of vessels may occur, followed by fatty degeneration and softening or gangrene of the wall. Suppuration within the cyst may cause it. In papillomatous cysts the papillary growths may perforate the wall. Blows, falls, injury during labor, or physical examination may cause rupture.

Rupture into the peritoneal cavity is the most frequent; the results of this depend on the quantity and quality of the fluid. In the large unilocular cystomata the escaped fluid may be absorbed and the rent close again; these are the least dangerous. In the smaller ones the contents are more difficult of absorption, and may remain for quite a time in the peritoneal cavity without leading to marked changes. If, however, the discharged contents be mixed with blood, pus, or the contents of a dermoid, peritonitis, either circumscribed or diffuse, may result; frequently, the latter, with lethal issue. If much fluid escapes, the tumor diminishes in size and shape and becomes flaccid in part. After papillomatous cysts rupture, secondary papillary developments generally take place in the peritoneum. Fluid is also increased in the latter—hydroperitoneum.

When the cyst fluid is gelatinous or colloid, small masses of it often become attached to the peritoneum, which becomes congested and roughened. This may lead to crepitus on palpation. These masses are termed pseudomyxoma.

Perforation into the intestines may occur, most frequently into the rectum. This may lead to some improvement in certain cases; but usually infection and sometimes gangrene may set in. Rupture into the stomach or small intestine is rare. Perforation may also take place through the bladder, vagina, abdominal wall, or Fallopian tube.

Hemorrhage in the Cysts.—Sometimes this may be due to rupture of a vessel in connection with the increase in size of a cyst. It may occur after puncture. In papillomatous cysts spontaneous hemorrhage may take place. The most common cause is torsion of the pedicle. Generally it is slow and gradual, but it may be sudden and extensive, giving rise to rapid increase in size.

Gangrene may occur as the result of twisting of the pedicle, interfering with the circulation. It may follow prolonged or severe pressure, *e. g.*, that due to marked incarceration in the pelvis or that caused by the passage of a fetus in labor. It may be associated with excessive infection or hemorrhage in the tumor-wall.

Torsion of the uterus may also be induced by ovarian tumors. It may develop gradually or suddenly, producing symptoms similar to those caused by torsion of a tumor.

Symptoms Associated with Ovarian Cysts.—By far the greater number develop slowly, ovarian cysts often producing no symptoms until considerably advanced in size and reaching above the umbilicus. Sometimes the patient discovers the tumor accidentally herself. One of the commonest early

symptoms is vesical tenesmus, constipation, or pain on defecation. Pains in the pelvis or abdomen are often the first symptom. There may be nervous phenomena, *e. g.*, syncope. Generally the patient begins to feel ill only when the stomach functions are interfered with.

Dyspeptic symptoms usually gradually develop, and nutrition suffers. The patient loses flesh and strength. Abdominal pains may develop from peritonitis. Edema of the lower part of the body may supervene, and death may occur from exhaustion.

In other cases symptoms develop early, while the tumor is small and still in the pelvis. There are pelvic pains and difficulty of micturition and defecation, being the more pronounced the more the incarceration is marked. These pass away if the tumor rises out of the pelvis. Attacks of pain are produced also when the tumor is small, as a result of peritonitis or torsion. It is best to consider the symptoms, as Olshausen does, according to the following plan:

I. Symptoms Produced by Ovarian Disease per se.—These mainly refer to menstruation. As a rule, it is not much interfered with. But all forms of disturbance are found in the course of the disease. Dysmenorrhea is very rare. Early menorrhagia is somewhat frequent, often metrorrhagia also occurs, especially in double broad-ligament cysts, probably due to interference with the pelvic circulation. As a result of this loss of blood considerable anemia may follow.

Amenorrhea may occur. If the patient's health be good, this may be due to bilateral cysts of the ovaries, malignant disease, pregnancy. It may often be due to a poor general condition of health. Sterility may result from ovarian tumors, though pregnancy may take place with large or even with bilateral ones. It is important to note that these tumors may cause certain signs of pregnancy, *e. g.*, mammary areola, enlargement and pains in the breasts, secretion of colostrum.

II. Symptoms Due to Pressure of the Cysts.—1. Small tumors impacted in the pelvis cause pelvic pains, difficulty in micturition and defecation. These are aggravated if inflammation supervenes.

2. Large tumors growing into the abdomen may also drag on the bladder and cause tenesmus; this may also produce dragging pains. Digestion is interfered with, as the stomach and intestines are pressed on, though alterations may not be marked for a considerable time. In extreme cases the diaphragm is pressed upward and breathing is interfered with, and even the heart may also be displaced upward and to the left, and palpitation produced. Degeneration of cardiac muscle is often present in patients with large cysts.

The renal veins may be compressed and albuminuria caused. The ureters may be pressed on, leading to their dilation and hydronephrosis. This may lead to total suppression of urine.

In many cases of large cysts only small amounts of concentrated urine are passed, depositing mixed urates on standing. Cystitis may be caused by ovarian cysts, and when septic, may lead to secondary kidney infection. In patients dying with large ovarian tumors or dying after ovariectomies it has been remarked that kidney disease is very often present.

Hemorrhoids, varix, and edema of the lower limbs as a result of pressure

on abdominal veins is not frequent. Ascites is rare as a result of mere pressure. It may be due to associated renal, cardiac, hepatic, or intestinal complications.

The uterus may be somewhat displaced. Sometimes it may be dragged upward by the traction of the cyst on the broad ligament, and may be more or less twisted. In other cases it may be forced downward. Separation of the recti abdominis muscles is usually produced by large growths; umbilical hernia is sometimes found.

III. Symptoms Due to Complicating Conditions.—Peritonitis is common. In many cases no symptoms are produced in the development of even marked adhesions; they may, however, be accompanied by pains. Sometimes, owing to pressure or to adhesions, the bowel functions are disturbed, irritation and diarrhea being caused.

Hemorrhage into the cyst may cause no symptoms in cases where it is slow and scanty. Sometimes it may produce rapid increase in size of the tumor, acute anemia, collapse, very frequent and feeble pulse, and death.

Suppuration or gangrene is associated with the usual symptoms of septic infection.

Torsion of the pedicle produces symptoms which vary according to the acuteness of the attack. In a typical case, suddenly produced, there are sharp abdominal pain and shock; if marked hemorrhage takes place in the cyst, additional symptoms are present.

If the patient recovers, she suffers from poor health, due to the peritonitis and other conditions present.

Slowly produced torsion may produce only symptoms of chronic peritonitis. Sometimes, however, torsion may exist with no inflammation, even though considerable hemorrhage occur in the cyst.

Rupture of the cyst may be followed in some cases by no symptoms when innocuous fluid escapes into the peritoneal cavity. When harmful fluids suddenly escape there may be collapse, shock, or symptoms of acute peritonitis. In other cases, especially where rupture occurs slowly, peritonitis may only gradually be developed. Often marked diuresis and diaphoresis take place.

When rupture has taken place into the intestines, the cyst contents are passed by the rectum, and copious diarrhea may be set up. When the bladder is opened into, vesical tenesmus and dysuria are marked.

Ascites may occur in association with ovarian tumors as a result of inflammation, torsion, or pressure. It is, however, chiefly associated with papillary growths, especially when secondary peritoneal dissemination has occurred, and with malignant tumors.

PHYSICAL SIGNS IN OVARIAN CYSTS.

(a) ENTIRELY WITHIN THE PELVIS.

1. Lateral to the Uterus.—*Physical Signs.*—Bimanually, a rounded, firm mass is felt at the side of the uterus, movable unless fixed by adhesions. If very small, it may be at the normal level of the ovary; if larger, on a

lower plane, usually behind the broad ligament, rarely in front of it. These small cysts may in rare cases feel elastic or give fluctuation.

2. Behind the Uterus.—*Physical Signs.*—Bimanually, a rounded, firm mass is felt in the pouch of Douglas, pushing the uterus to the front; if it be not impacted nor adherent, it may be moved freely. Sometimes it may feel quite solid, especially in the case of dermoids. The connection of a pedicle with the uterus may be made out, especially by rectal examination or on pulling down the cervix uteri with the volsellum. Sometimes it is necessary to pass a sound to outline the uterus clearly.

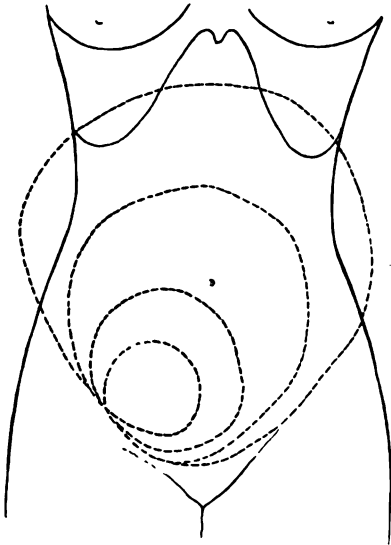


Fig. 206.—Outline showing the gradual increase in size of a multilocular ovarian cystoma.

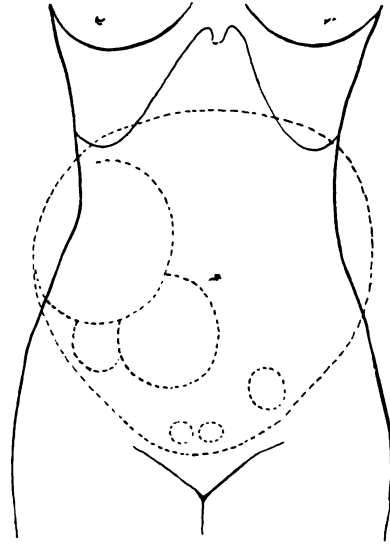


Fig. 207.—Outline of a multilocular ovarian cystoma.

These small ovarian cystomata in the pelvis must be distinguished from:

1. Encysted peritonitic effusions (perimetritis).
2. Cellulitic effusions (parametritis).
3. Hematocele and hematoma.
4. Broad-ligament cysts.
5. Hydrosalpinx, hematosalpinx, and pyosalpinx.
6. Ectopic gestation.
7. Fibroid and fibrocystic tumors of the uterus.
8. Retroversion of the gravid uterus.
9. Solid ovarian tumors.
10. Kidney displaced in the pelvis.
11. Fecal mass in the sigmoid flexure.

Encysted pelvic peritonitic effusions may be mesial or lateral, and may, on physical examination, simulate small ovarian cysts. In case of the former there

is usually a history of inflammation, associated with pain, elevation of temperature, etc. The swelling tends to become smaller in the course of a few weeks, whereas the ovarian swelling does not diminish.

A *cellulitic (parametric) effusion* in the broad ligament may also simulate a small ovarian cyst, but is distinguished from it by the history of inflammation and the tendency to subsidence.

Pelvic hematocoele or hematoma may form a swelling resembling an ovarian cyst, but there is usually a history of a very sudden occurrence, with shock. The hematocoele is, except in the early stages, firmer than most ovarian cysts. When the extravasation is within the pelvic peritoneum, the latter is usually molded by the blood-mass. It must, however, be remembered that an impacted or adherent ovarian cyst may also develop irregularly and mold to the pelvic cavity. The blood-mass, however, diminishes in size, whereas the cyst does not.

A *broad-ligament cyst* may closely simulate an ovarian cyst and cannot usually be distinguished unless the ovary (which should always be searched for) is felt distinct from it on bimanual examination. The ligamentous cyst is fixed, whereas the small ovarian cyst is movable unless impacted or adherent. As the former grows there is gradual displacement of the uterus and bladder; it is usually less tense than the ovarian cyst.

Tubal distentions may closely simulate small ovarian cysts. On careful examination their more elongated form may usually be distinguished. Very often there is a history of infection and inflammation. They may not increase during many months, whereas the ovarian cyst gets gradually larger.

An *ectopic gestation*, either in the tube or ovary, may form a swelling difficult to distinguish from an ovarian cyst. The secondary signs and symptoms of pregnancy, especially softening and discoloration of the vagina and cervix, irregular menstruation, and rapid growth of the swelling point more to ectopic gestation than to small ovarian cyst. Yet it must be remembered that various of the secondary signs and symptoms of pregnancy may accompany the growth of the latter.

Fibroid and fibrocystic uterine tumors may be mistaken for ovarian cysts, but the difficulty in diagnosis is greatest in the case of large swellings. A small growth extending laterally may simulate an ovarian cyst adherent to the uterus, as may one lying in the pouch of Douglas. A soft myoma or a cystic fibroid may feel exactly like an ovarian cyst. The latter grows more rapidly than the great majority of uterine fibroids. Fibroids very often cause menorrhagia and metrorrhagia; this is not so often the case with ovarian cysts.

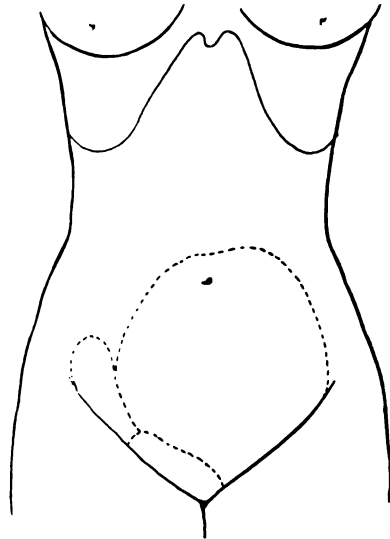


Fig. 208.—Outline of a left broad-ligament cyst displacing uterus and bladder laterally.

Retroversion of the gravid uterus may sometimes be mistaken for an ovarian cyst posterior to the uterus. In the former, however, there are usually the normal signs and symptoms of pregnancy. The cervix is pushed forward and upward, and the enlarged pregnant body varies in consistence. The fetus may occasionally be palpated on rectal examination.

Solid ovarian tumors may closely simulate tense or firm cystic growths. They are frequently associated with ascites. Malignant growths are often adherent and tend to cause early loss of weight and cachexia.

Kidney Displaced Downward into the Pelvis.—This may be mistaken for an ovarian or tubal enlargement or for a uterine fibroid. It is usually movable and sensitive to pressure, and has a characteristic shape. Attacks of pain may occur from time to time, owing to kinking or torsion of the ureter. Sometimes there may be distention of the pelvis of the kidney. On placing the patient in the elevated lithotomy position, the organ usually moves to a higher position in the abdomen, sometimes even to its normal situation.

A fecal mass in the sigmoid flexure may sometimes simulate an ovarian tumor. There is usually a history of constipation or of constipation and diarrhea. On bimanual examination the mass may usually be indented. It disappears after the thorough use of cathartics and enemata.

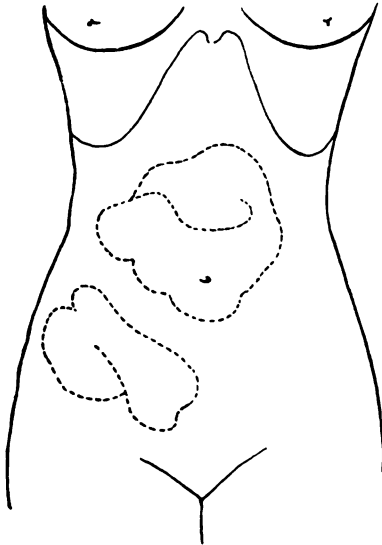


Fig. 209.—Irregular masses in abdomen due to feces after several days of constipation.

(b) WHEN THE CYST IS LARGE AND ABDOMINAL.

On inspection the abdomen is larger than normal. The distention may be especially marked on one side, but it is often uniform. The abdominal veins are often dilated, and lineæ albicantes present. The measurement from the anterosuperior iliac spine to the umbilicus is usually greater on the side to which the tumor belongs. In very marked cases the abdomen is pendulous and smooth; the lower ribs may be bulged outward.

On palpation the tumor may be defined above and at the sides, except when very large or when the abdominal wall is too thick or tense. It is felt to be more or less spheric, but irregularities may develop as secondary cysts become marked. The resistance is elastic in parts or over the whole tumor, and fluctuation may be obtained, except in cases where the cyst contains numerous small cavities or thick fluid, or where the abdominal walls are thick. Sometimes, in a lax condition of the abdomen, the hand may be passed around a considerable part of the tumor. It is important to note, during the examination of the abdomen, that there is no variation in the consistence of the cyst-wall (alternate hardening and softening) similar to that taking place in the

pregnant uterus. On bimanual examination the uterus can usually be made out to be distinct from the tumor (unless adhesions exist) and independently mobile, attached as it is by means of the pedicle at one corner. Fluctuation may also be sometimes obtained bimanually.

The uterus is generally displaced anteriorly, and often elevated, and usually on one or other side of the middle line. It may be elongated by traction. In other cases it is not elevated, but may be found retroverted, lateriverted, or even prolapsed. The larger the cyst, the more hindrance there is to uterine mobility.

The vagina is elongated if the uterus is dragged upward.

On percussion various signs are obtained. With the patient in the dorsal position, in the case of a cyst not too large, there is dulness over the whole tumor, which is surrounded above and laterally by a tympanitic note due to the air-containing intestines; the latter varies, of course, according to the presence of feces or gas in the bowel, and it may be altered, especially laterally, by fluid in the peritoneal cavity.

On changing the position of the patient the percussion results are found to be the same, though there may be a variation if the tumor is not very large and very movable.

In cases of the largest cysts, the intestines are so pushed back that they give a note in the loins posteriorly. The transverse colon and stomach do not reach the abdominal wall. The hepatic dulness disappears anteriorly as far round as the axilla. The diaphragm is pushed up and may reach as high as the second rib on the right side. The lungs and heart are markedly displaced upward. Splenic dulness is lost.

On auscultation no bruit is heard, as in the case of a fibroid or a pregnant uterus. Friction or creaking may be heard when there are peritonitic thickenings, or when colloid matter escapes from the cyst, or from one cyst cavity to another. *Adhesions*, when present, may cause tenderness on palpation, though often this is absent. Sometimes the cyst may be felt to move only with the abdominal wall, and not independent of it. Intestines may be adherent in front of the tumor, giving a tympanitic note on percussion and borborygmi on auscultation. In a large number of cases it is impossible to diagnose adhesions.

Rupture, if it occurs and a considerable quantity of fluid escapes, causes the tumor to diminish in size and change shape, palpation often revealing a peculiar flaccidity. *Free fluid* may sometimes be detected in the peritoneal cavity.

Differential Diagnosis of Large Ovarian Cysts.—There are many abdominal and pelvic tumors which it may be difficult to distinguish from these large cysts. The most important are as follows:

1. Fluid in the peritoneal cavity, free or encysted.
2. Fibroids and fibrocystic tumors of the uterus.
3. Distended bladder; cyst of the urachus.
4. Obesity.
5. Phantom tumor.
6. Pregnancy; hydramnios.
7. Hematoma; hematocele.
8. Ectopic pregnancy.
9. Omental, mesenteric, and retroperitoneal tumors.

10. Renal, splenic, and hepatic enlargements.
11. Fecal accumulation.
12. Hydatid cysts.

Ascites.—A large quantity of free ascitic fluid may form an abdominal enlargement which may simulate a large ovarian cyst. In the former condition, as the woman lies on her back, there is dulness over the lower portion of the abdomen anteriorly, and in the lumbar region. As the position is changed, so there is a change in the areas of tympanites and dulness. A large cyst rarely causes dulness in the flanks unless the growth has extended into them, or unless there is ascites as well or much fecal matter in the colon; there is no change in cystoma of the areas of dulness and resonance with change of position. In the case of extensive ascites there is frequently evidence of heart, kidney, or liver disease or abdominal tuberculosis or malignancy.

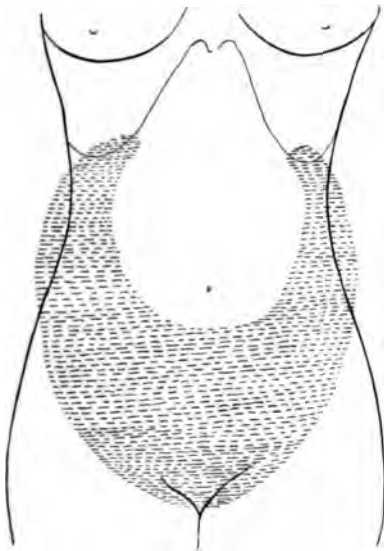


Fig. 210.—Outline showing free ascitic fluid in abdomen when patient lies on her back.

A large circumscribed ascites walled in by adhesions may resemble an ovarian cyst so closely as to be indistinguishable from it. The most common cause of this condition is tuberculosis, and evidence of this should be sought for in other organs. Also an attempt should be made to locate the ovary, the finding of which is fair evidence of the non-ovarian origin of the tumor.

Fibroids.—Large fibroids, especially soft myomata and fibrocystic tumors, may simulate ovarian cysts. Menorrhagia or metrorrhagia is suggestive of the uterine origin of the tumor, as is a history of enlargement of the abdomen during several years. A souffle may often be heard over the abdomen in the case of fibroids, rarely in ovarian tumors.

Distended Bladder.—The abdominal swelling produced by a greatly distended bladder may simulate an ovarian cyst.

The passage of a catheter suffices to establish the nature of a urinary accumulation.

Cyst of the Urachus.—Sometimes a large cyst of the urachus may be mistaken for an ovarian tumor. Such a swelling may occupy a large portion of the abdomen. It is usually of slow growth, and is mesial in position from the time it is first noticed. The nature of the swelling is determined only when operative treatment is carried out. It is then found to be entirely extraperitoneal.

Obesity.—A fat abdominal wall, especially if protuberant or associated with diastasis of the recti muscles and enteroptosis, may occasionally simulate an ovarian cyst. On careful percussion no definite area of dulness is found. Examination under anesthesia may sometimes be necessary in order to determine that no large tense cyst is present, also in cases where there is much

flatulent distention the woman may believe that she has a tumor, and anesthesia may be very necessary to prove that one does not exist.

Pregnancy.—The enlarged pregnant uterus may simulate a large ovarian cyst. A mistake in diagnosis is most apt to be made when the uterus is distended by hydramnios, when the pregnancy has occurred during a long period of amenorrhea, or when discharges of blood have escaped from the uterus during the pregnancy.

Careful examination, however, should always determine the pregnancy, variation in the consistence of the tumor, fetal parts, the fetal heart, and ballotement being found.

Ectopic Pregnancy.—An advanced ectopic pregnancy can be definitely diagnosed only when the fetus is recognized and the empty uterus distinctly felt. Usually in such cases the progress of the enlargement is marked by constant or recurring pains, and these are rarely present in ovarian cystomata. In old cases of ectopic gestation in which the fetus has died it may be more difficult to determine the nature of the tumor, though frequently the bones of the fetus may be easily palpated.

Omental, Mesenteric, and Retroperitoneal Growths.—These, when large, may closely simulate ovarian cysts. Unless they extend into the pelvis, the fingers may usually be able to depress the abdominal wall above the pubes toward the promontory. On careful bimanual examination of the pelvis the uterus and adnexa may often be felt to be distinct from the tumor.

On careful investigation of the history in the case of such growths it may frequently be found that in the early stages the swelling is noticed in the middle or upper portion of the abdomen.

Renal, Splenic, and Hepatic Enlargements.—When such swellings are large and extend toward the pelvis, they may be mistaken for ovarian cysts. This is especially true of renal and splenic growths. An enlarged spleen on the left side may dip into the pelvis. It has a firm consistence, and notches on the anterior border may usually be palpated; such a growth is generally associated with leukemia or splenic anemia. Sometimes an enlarged spleen may be displaced to the right side and may lie partly in the pelvis, as in a case reported by me in the "Journal of the American Medical Association." Attacks of pain due to torsion may have been present.

Renal new-growths or hydronephrosis may form lateral swellings which may simulate ovarian cysts. In such cases the examination of the urine may indicate the renal nature of the swelling. Careful bimanual examination

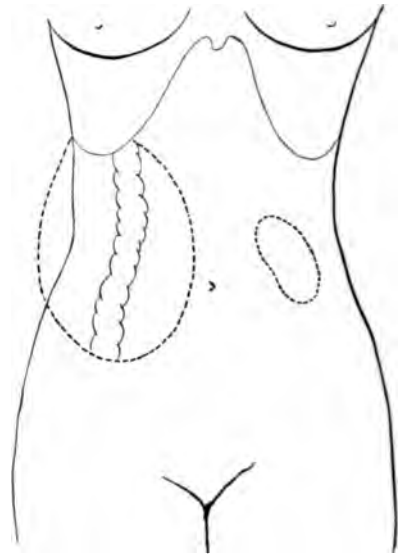


Fig. 211.—Outline showing a large hydronephrosis on right side and a suppurating kidney on the left side.

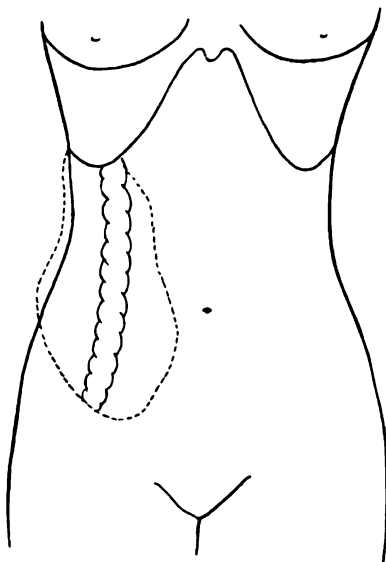


Fig. 212.—Outline of a right hypernephroma, with the colon in front of it.

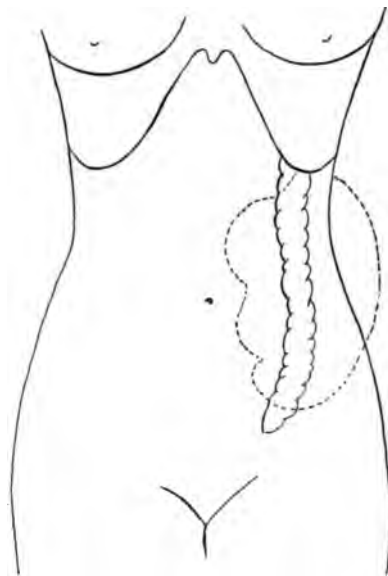


Fig. 213.—Outline of left renal tumor with colon in front.

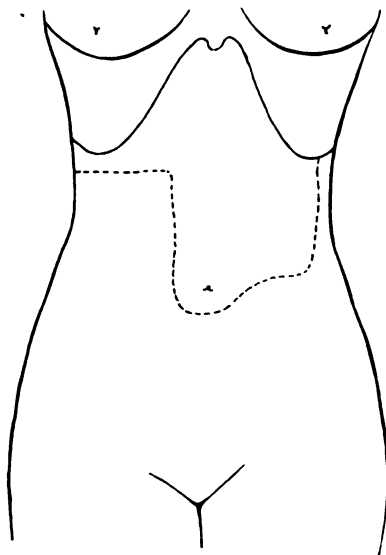


Fig. 214.—Enlarged left lobe of liver due to carcinoma.

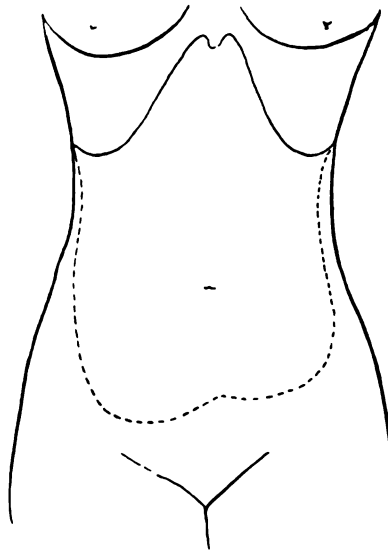


Fig. 215.—Outline of liver very greatly enlarged.

of the pelvis may enable the uterus and adnexa to be palpated. Sometimes a renal swelling may lie in or near the pelvis, and may thus more easily be mistaken for an ovarian growth. Hepatic enlargements are usually felt in the upper abdomen. Occasionally the right lobe of the liver may extend downward toward the pelvis, with or without a distended gall-bladder, and may be mistaken for an ovarian swelling.

Fecal Accumulation.—Occasionally a large collection of feces in the colon or sigmoid flexure, especially if associated with flatulent distention of the bowel above, may be mistaken for an ovarian tumor. The nature of the swelling is established by the use of purgatives and enemata.

Hydatid Cysts.—These may develop in different portions of the abdomen and pelvis and may closely resemble ovarian cysts. Unless both ovaries can be palpated on careful bimanual examination, the diagnosis may be established only when operative treatment is carried out.

(c) WHEN THERE ARE BILATERAL OVARIAN CYSTS.

This condition can be exactly diagnosed only when the tumors are not too large or not too close together; also it is easier when they are unequal in size. Where two large cysts are close together, the sulcus between them may be mistaken for the depression between two parts of the same cyst, and vice versa.

If the cysts are not very large and nonadherent, independent mobility may be elicited. Sometimes they may become firmly adherent and a communication may open between them.

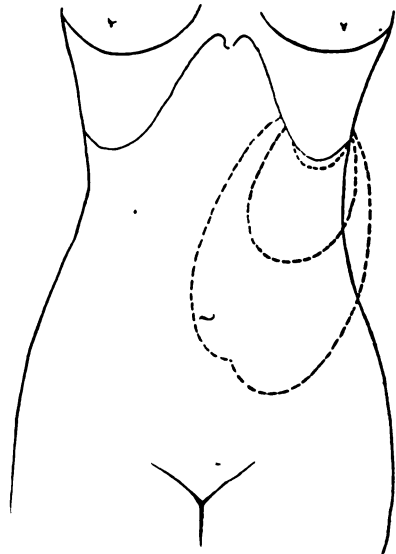


Fig. 216.—Outline showing various degrees of downward extension of enlarged spleen.

OVARIAN HYDROCELE.

This term has been given by Bland Sutton to a sac containing thin fluid found occasionally on the posterior layer of the broad ligament. The outer end of the Fallopian tube, which is elongated and somewhat dilated, usually communicates with the sac. In small cysts the ovary projects on the floor of the sac; in large ones it is spread out and blended with the sac-wall, often being unrecognizable as a distinct structure.

The condition is due to the distention of a fold of peritoneum, which occasionally surrounds the ovary—the so-called “ovarian sac.” This sac, in certain mammals, exists normally as a covering to the ovary, *e. g.*, hyena, rat, mouse, mare, guinea-pig. In others, *e. g.*, porcupine, baboon, the sac is partly formed. Cases of ovarian hydrocele are sometimes found in some of these mammals.

The hydrocele may in some cases empty itself from time to time through the tube and uterus. Sometime the contents are purulent.

SOLID TUMORS OF THE OVARY.

Fibroma; Fibromyoma.—Fibroid tumors of the ovary are comparatively rare. From statistics of Peterson and others such growths tend to occur earlier and in relatively greater numbers in early sexual life than do fibroids of the uterus. Fairbairn states that in the great majority of cases the tumor originates in the ovarian stroma; occasionally it may possibly grow from the tunica fibrosa of a Graafian follicle. Doran believes they may sometimes develop from the utero-ovarian ligament. In most cases the growth is

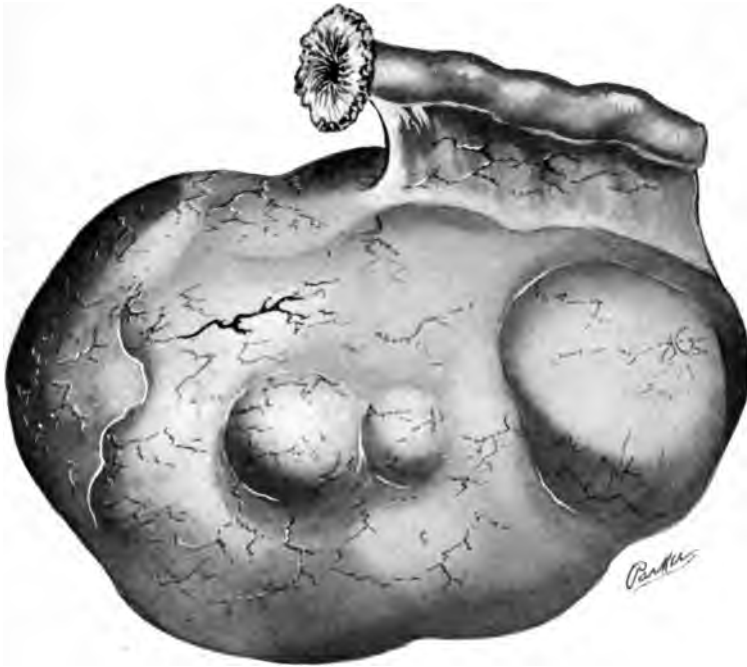


Fig. 217.—Ovarian fibroma.

slow, though sometimes it may be rapid, a change being noticeable in the course of several months. The growth is firm, smooth, or nodular, and may be found at one portion of the ovary or may obliterate the whole organ. Sometimes it may be pedunculated. It may be rounded, ovoid, or have other shapes. The tumor may reach a large size. Fleischmann has reported a case in which it weighed twenty pounds. The surface is usually pinkish-white or yellowish-white, though other tinges may be present.

Cysts are occasionally present in the mass, and may contain clear, bloody, or turbid fluid. Colloid, hyaline, and myxomatous degeneration is frequently found. Calcification is sometimes found and may form large masses. In some cases the solid structure is chiefly fibrous tissue, little muscular tissue being

found; in others the latter is prominent. Pure myoma is very rare. The tumor is usually mobile except when fixed by adhesions or when very large.

In eighty-four cases collected by Peterson, adhesions were present in 36 per cent. The pedicle varies in length; as a rule, it is long and thin. Ascites is frequent: according to Peterson, in about 40 per cent. of cases. The fluid is usually clear. The cause of its occurrence is uncertain. The largest quantity is not necessarily found with the largest tumor. In some cases it may be very abundant.

The clinical symptoms vary. No definite relationship to menstrual disturbances can be established. Peterson believes that the time at which the menopause appears is rather later than normal. Pain is caused in some cases, usually when adhesions are present. Dysuria is present in a considerable number of cases.



Fig. 218.—Solid papillomatous growth of ovary.

Solid Ovarian Tumors with Cells Resembling Ova.—Orthmann, Gebbard, Acconci, Emanuel, and Fothergill have described a rare growth with the following characteristics given by the latter author. The stroma consists of fibrous tissue containing spaces filled with epithelioid cells. The peripheral row consists of radially placed cylindric cells, the inner ones being rounded or polygonal. Among these is a large cell resembling the ovum, with a large nucleus; sometimes two or three such cells are found. They are either true ova or cells of the membrana granulosa enlarged under a special stimulus. They may occur in women long after the change of life, apparently indicating that remains of the germ-epithelium may represent a potential egg function.

Papilloma of the Ovary.—Occasionally the ovary may present papillomatous growths from the surface exactly resembling those found in papillomatous cysts. They may be found without any cystic changes in the ovary. Williams believes that they are always derived from the germinal epithelium.

They may extend to surrounding peritoneum and small portions may be implanted at a distance.

Primary Carcinoma.—Various types are found. The entire mass is

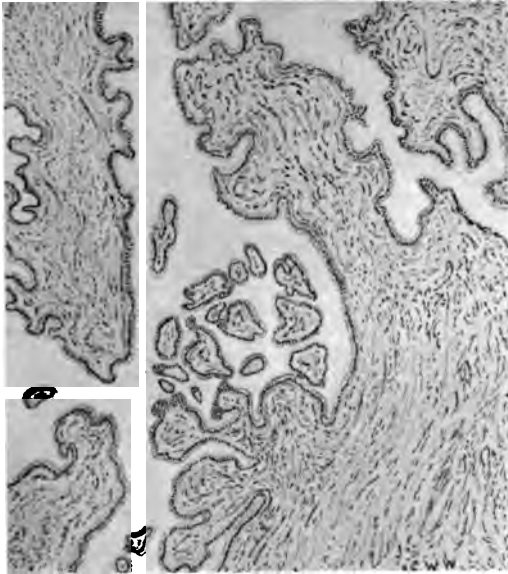


Fig. 219.—Papilloma of ovary ($\times 32\frac{1}{2}$).

solid in some cases, being irregularly rounded and pedunculated. The disease may be bilateral. Rarely is the swelling intraligamentous. The outer part of the mass is often dense. The interior varies in consistence, degenerative and hemorrhagic areas being common. The cancer-cells are variously arranged. They may be collected in alveoli which vary in size, or they may extend diffusely. The term "medullary" is often applied to this group.

In another class of cases the tumor is cystic, resembling externally a serous cyst. They rarely reach the size of an adult head. They are frequently bilateral, and may be partly or entirely intraliga-

mentous. Frequently papillary growths are noticed on the outer surface of the cyst; on the inner surface, they are always present. These tumors are adenocarcinoma, many variations of papillæ and gland-like formations being found. All gradations from the structure of the benign cystoma to that of the adenocarcinoma may be studied. In the malignant form there is atypical proliferation of the epithelial cells, which tend to accumulate in layers. In some solid portions the medullary arrangement may also be noticed. Psammomata are common.

Metastases are common, especially in the peritoneum. The omentum, liver, stomach, and other structures may be invaded. When the disease exists on one side, metastasis may be found in the opposite ovary. Steffek has found that the latter may exist, even though the ovary may appear normal to the naked eye.

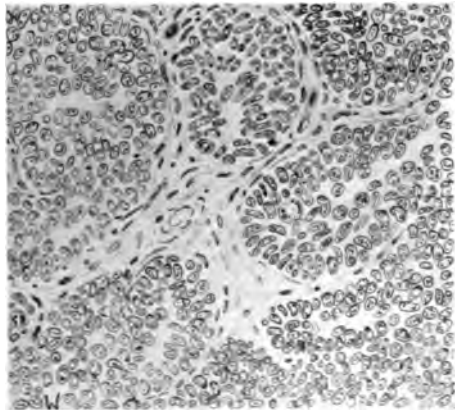


Fig. 220.—Cancer of ovary ($\times 265\frac{1}{2}$).

Secondary Carcinoma.—This is rare. It may follow uterine cancer, especially of the body. It may, however, occur after cancer in the breast, stomach, and other organs.

Schlagenhauser has studied 79 reports of cases in which both ovaries were involved. In 61 there was malignant disease in the stomach; in 10 in the intestine; in 7 in the biliary passages; in 1 in the suprarenal gland. In very old people with stomach carcinoma it is very rare to find metastases in the ovary, whose function had ended years previously.

Primary Sarcoma.—This disease is less frequent than carcinoma of the ovary. It is most common between twenty and thirty, but may be found at other periods, even during intra-uterine life. It may be unilateral or bilateral. The latter condition may be due to metastasis from one side to the other. The tumor is generally rounded, smooth, or nodular. It is usually of rapid growth and may reach a large size. Sometimes a portion of unaltered ovary may be found attached to the growth, though frequently the entire organ is obliterated. The mass is usually pedunculated.

Histologically, various appearances are found. Spindle-cells are more frequent than other varieties, yet round-cells are very common and may be found along with the others. The more abundant the spindle-cells, the firmer the tumor. Sometimes sections may resemble carcinoma, due to the occasional alveolar arrangement of sarcomatous cells, or, possibly, in some cases to inclusion of Graafian follicles by the growing sarcomatous tissue. Melanotic growths are very rare. Donati has described a unique case of cystic osteochondrosarcoma with giant-cells. Metastases tend to develop in various portions of the body. Ascites is usually present. Hemorrhage, cystic, myxomatous, and fatty degeneration are often present.

Endothelioma.—This is a very rare malignant growth. It has been known by other names, viz., angiosarcoma, lymphangiosarcoma, lymph-angioma cystomatosum. Marchand, in 1879, first used the term endothelioma, indicating the origin of the tumor.

The growth has been observed in childhood and in adult life. It is usually



Fig. 221.—Section of a multilocular cyst of the ovary, containing areas of carcinoma: a, b, Carcinomatous areas; c, necrotic area.

unilateral, but may be bilateral. It may reach a size of several inches in diameter, and is irregularly rounded and nodulated. Metastases occur as in other malignant growths. On section, various appearances may be found. It may be mostly solid, consisting of firm and soft areas. Sometimes it is full of small cavities, or it may have a cavernous structure. Rarely, cysts of considerable size may form. Occasionally papillary growths may be found. Various forms of degeneration are common. These neoplasms develop from the endothelium of blood-vessels or lymphatics. They may be found with other tumors of the ovary. Pick describes the following arrangements of cells as seen under the microscope:

1. The cells are arranged in chains which lie in narrow clefts in the fibrous stroma; they may frequently be branched.
2. Gland-like arrangements, somewhat similar to those found in adenocarcinoma, the cells being in one or more layers.
3. Alveolar arrangement, clusters of epithelioid cells being found in the midst of the fibrous tissue, somewhat resembling the structure in alveolar sarcoma.

These types may be found in the same tumor.

Diagnosis of Malignant Ovarian Growths.—Rapidity of growth is usually observed. The patient may notice the swelling in one or both iliac regions. Frequently, however, attention is first drawn to general distention of the abdomen as the result of ascites, which is generally present. Pain is a variable symptom. In some cases it may be slight or absent. Edema of the lower limb on the side of the tumor is common. Progressive cachexia and loss of weight mark the progress of the disease. The growth of metastases in other parts may give rise to various disturbances.

On bimanual examination the tumor may be felt. It is usually fixed after the early stages.

Prognosis.—The disease is fatal unless it be removed early. There is no hope if infiltration of neighboring tissues or implantation of small portions on the peritoneum has taken place.

Folliculoma Malignum Ovarii.—Under this term H. Schroeder and Gottschalk have described a tumor consisting of a connective-tissue stroma containing alveoli, which represent ripe Graafian follicles, each being lined with columnar epithelium within which is a protoplasmic disc surrounded by radially arranged epithelial cells. There are also many small structures resembling primordial follicles. Schroeder states that the same growth has been described by Mengershausen as *adenocarcinoma folliculare*, and by von Kahlden as adenoma folliculi Graafiani, and considers the group as a distinct one.

Hydatid Disease.—Primary echinococcus invasion of the ovary is almost unknown. One undoubted case has been reported by Pean.

Coexistence of Pregnancy and Ovarian Tumors.—Pregnancy may be found along with all varieties of ovarian tumor, unilateral or bilateral. Spiegelberg and Olshausen think that they often grow rapidly during pregnancy. The tumor may lie in the pelvis or in the abdomen. If in the pelvis, it usually lies in the pouch of Douglas; in the abdomen it generally lies lateral to the uterus and somewhat in front. The earlier the gestation and the smaller the tumor, the more easily can the uterus and tumor be distinguished by pal-

pation. In advanced pregnancy this is generally impossible. Sometimes the abdomen may be enormously distended in advanced pregnancy; and where pregnancy occurs with a large tumor, the tension of the abdominal wall may be great.

The patient is apt to suffer more than in ordinary pregnancy, *e. g.*, from varicose veins, edema of legs, bearing down, etc. This condition is rare as a complication of pregnancy. There is no ground for believing that pregnancy is in any way a causal factor in the production of ovarian tumors. They are not found more frequently in women who have been pregnant than in nulliparæ. Indeed, Sir J. Williams states that the tumors are proportionately far less frequent in the married than in the single. There is no proof that pregnancy accelerates their growth. In pregnancy, as in the nonpregnant state, some ovarian tumors grow quickly, others slowly, for unknown reasons a great range of variations being found. Sometimes a rapidly growing tumor may increase slowly when pregnancy occurs, though generally the same rate continues. In some cases a slowly growing tumor may continue steadily before, during, and after pregnancy. In other cases increase in size may occur only during a portion of the gestation period or after pregnancy. Leopold has stated that pregnancy favors malignant growths in the ovaries, and Wernich that it occasions malignant degeneration in ovarian cysts. Williams shows that there is no foundation whatever for these statements.

Twisting of the pedicle may occur in pregnancy, with the various sequelæ noticed in nonpregnant women. According to Williams, it is found three times more frequently in the former than in the latter. It is much more likely to take place when the tumor is above the brim than when it is below. The risk of rupture of the cyst is very slightly increased by pregnancy; this accident most often occurs in connection with delivery. Abortion and premature labors are frequent, though it is not possible to state from an analysis of published cases the exact percentage due to the tumors. It must be remembered that though an ovarian cyst complicates pregnancy, the interruption of gestation may be due to a number of other causes. Williams found that in 461 pregnancies abortion or premature labor took place in 58; Remy found 55 in 321 cases. In Williams' cases the percentage was greater with multilocular cysts than with dermoids. It was large in cancerous ovarian growths. Suppuration in a cyst is very rare in pregnancy; it is more frequent after labor. Hemorrhage into the cyst is also rare. Intestinal obstruction is very unusual.

Treatment of Ovarian Tumors.—Ovarian neoplasms should always be removed unless conditions exist which make the operation inadvisable or impossible. In this connection the technic to be followed in different cases is described.

Ovarian Cystomata.—The operation for the removal of an ovarian cyst has long been known as "ovariotomy." The nature of the procedure and the difficulty of manipulation vary according to the size and condition of the tumor, adhesions, condition of the patient's health, etc. For many years an abdominal incision has been employed for all varieties of cyst. In recent years various operators have advocated the advantage of anterior colpotomy for certain cases.

Small Cysts not Larger than Two Fists.—These may be removed by abdominal section or by anterior colpotomy. If there are many adhesions which

can be diagnosed, if the tumor be dermoid or malignant, the former of these methods alone should be employed.

The author usually employs the abdominal-route in order that the covering of all raw areas may be insured. By the vaginal route this cannot always be satisfactorily accomplished.

Vaginal Operation.—The method of performing anterior colpotomy is described on p. 251. When the peritoneum is opened, the fundus uteri is pulled down into the vagina. The ovarian cyst is then tapped with a trocar and afterward drawn downward into the vagina. The corresponding infundibulopelvic ligament is then ligated with catgut, so as to secure the ovarian vessels, and the anastomosing utero-ovarian vessels are tied near the uterus. The tumor is then removed, with or without the corresponding tube, and the raw area covered with peritoneum by means of a running catgut suture. The uterus is then replaced and the opening in the anterior fornix closed.

Large Cysts.—These should be removed only by the abdominal route.

Abdominal Operations.—The ordinary mesial incision is employed. In most instances it is sufficient to make this large enough to admit the hand. When the peritoneum is opened, the whitish surface of the cyst is seen. Very rarely is the omentum anterior to the lower portion of the tumor. The fingers of one hand are then introduced and carried over all the tumor to make

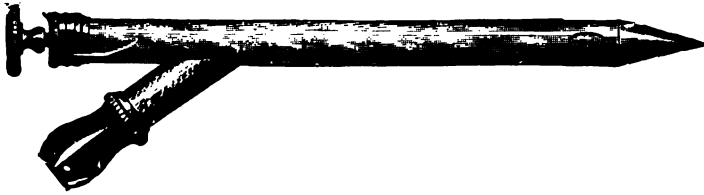


Fig. 222.—Pean's ovariectomy trocar.

out its relations and the presence of adhesions. If only a few parietal adhesions exist, they are broken with the fingers. If extensive, they are attended to after evacuation of the sac. Omental and intestinal adhesions are also left until after this is carried out.

Evacuation of Cyst.—In order to reduce the size of the tumor, the cystic contents must be removed, save when they are purulent or gangrenous; in such cases the tumor should be removed *en masse*.

Before puncture an assistant should steadily compress the patient's flanks with the palms of his hands and should continue in this position as long as fluid flows from the tumor.

The largest cyst near the abdominal incision is chosen for puncture. Various trocars are used. The simplest method is to pierce the cyst-wall with a knife. As the assistant presses in the flanks a thin stream of fluid (except when it is thick) flows steadily out as a jet and is caught in sterilized basins.

If the knife be not used, puncture may be made with a simple trocar and cannula, attached to a rubber tube. The latter hangs over the edge of the table and drains the cyst by siphon action. Large, complicated trocars are not necessary; they are difficult to keep clean.

If the puncture of one cyst is not sufficient to reduce the size of the tumor so that it can be removed, other cysts should be opened from the interior of the one already punctured. This may be done with a finger, knife, scissors, or trocar.

In some cases, on account of the colloid nature of the fluid or of the presence of fibrinous clots, nothing escapes in the tube. This happens also when the tumor-walls rupture, owing to their brittleness, or because the cyst is so numerously subdivided. In these conditions either the cyst should be removed *en bloc*, through a large abdominal incision, or, if too large for this, it should be opened so that the hand can be introduced to remove the contents and to break down the septa.

If the cyst-contents are gangrenous or purulent, the tumor should be removed *en masse*. If the dangerous character of the contents has been found out only after an opening has been made, the openings should be closed with forceps and the tumor removed from the abdomen through an enlarged incision.

Usually only slight hemorrhage results from the breaking down of the cyst interior. Sometimes, however, marked bleeding occurs. When this happens, the pedicle should be temporarily constricted with forceps until the cyst is removed from the cavity and the ligatures are ready to be applied.

Treatment of Adhesions.—After the evacuation of the cyst contents the edges of the opening are grasped in strong forceps and the tumor is drawn outward in order that adhesions may be severed. Parietal adhesions may be broken through with the finger-tips; when they are very tough and fibrous, they may require to be cut through.

When there is a circumscribed patch of dense adhesions, the corresponding part of the cyst-wall may require to be cut from the rest of the sac; in such a case the lining secreting portion should be entirely dissected off.

Oozing takes place from torn adhesions. It may be checked by pressure of a hot sponge. Any points that bleed particularly freely may be tied or burned with a cautery. It may be necessary to pass the catgut through the tissue by means of a needle.

Parietal adhesions over the front of the tumor may make it difficult to know where the peritoneum is during the opening of the abdomen. In attempting to strip off adhesions, one may at the same time remove the parietal peritoneum. After evacuating the cyst the distinction can usually be made, and proper separation of the adhesions carried out. Omental adhesions are next in frequency after parietal adhesions. Usually the omentum lies above the umbilicus. If it should lie in front of the tumor below the umbilicus, so as to interfere with the opening into the cyst, the incision should be prolonged downward in order that the omentum may not be wounded. Sometimes, however, it reaches to the symphysis.

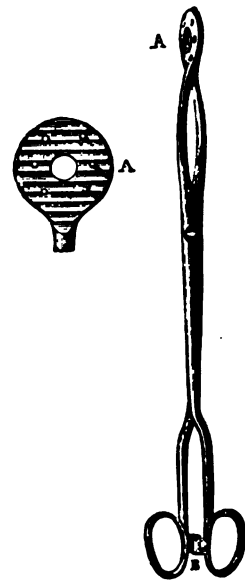


Fig. 223.—Nélaton's cyst-forceps: A, A, Circular jaws with holes and pegs; B, catch.

It should be separated from the parietes, and an endeavor should be made to get to one side of it in order to puncture the cyst. If a piece of the omentum which is in the way can be conveniently ligated and divided, this may be done. If there is no other method, it may be necessary to puncture the omentum in order to enter the cyst.

In drawing out the tumor the omental adhesions are gradually torn through. This is best brought about by rubbing them off with a dry sponge or gauze pad. Firm bands may require to be torn through with a pair of forceps or with the fingers. Bleeding vessels in the omentum may be ligated with catgut, but if, when the omentum is freed, any extensive oozing surface should remain, strong catgut (No. 3) ligatures should be tied around it and the oozing part cut away. The omental stump should then be rolled up on itself and covered by means of a fine continuous catgut suture.

Adhesions to mesentery and intestine are not very common. They are usually found on the back and sides of the cyst. If the adhesions are short, they should be torn through by being rubbed off the cyst with a sponge or cut with a knife. If they are long, the bands should be ligated and cut. If the adhesions are very firm and short, it may be necessary to dissect a portion of the outer wall of the cyst to which they are attached, leaving it in continuity with the bowel or mesentery, care being taken that no part of the inner secreting surface is left.

When intestine is adherent to the pedicle, it may not be easily recognized. Or, when the pedicle is very broad and there are no adhesions, the operator may think that the bowel is adherent. Whenever raw areas are left after the separation of adhesions, they should be covered as much as possible with neighboring peritoneum by means of fine catgut.

Mesenteric adhesions should be separated and then ligated, or vice versa. If the vermiform appendix be adherent, the adhesions should be divided and the appendix removed. Splenic and hepatic adhesions must be divided with the greatest care. Uterine adhesions are mostly found in cysts which lie in the pouch of Douglas and are adherent to it.

Bladder adhesions must be carefully dealt with. Sometimes the attached bladder may be mistaken for part of the cyst, and there is danger of cutting into it or removing it. This mistake is most apt to occur when the bladder is markedly displaced upward. When the adhesions are divided, bleeding points should be ligated.

Adhesions to the pelvic floor may be difficult to separate. Sometimes it is quite impossible. There is danger of tearing into a large vessel—the ureter, the bowel, or the vagina. Bleeding points on the tumor may be held with forceps or with ligatures until the pedicle is tied.

Treatment of the Pedicle.—The pedicle consists of the tube, broad, ovarian, and infundibulopelvic ligaments. It varies greatly in length and width in different cases.

In cases of torsion it may be very friable, the vessels being closed by thrombi. Sometimes the pedicle is double, as a result of atrophy of an intermediate portion.

The appendages of the opposite side may be adherent to the cyst, making it difficult at first to say to which side the tumor belongs. Intestines may become adherent to the pedicle and should be separated.

No pedicle can be found in some cases where torsion has occurred, the original pedicle having been entirely twisted off; the tumor thereafter is nourished by means of the vessels of the adhesions which have formed. If the tumor has developed between the layers of the broad ligament, or if it has grown behind the ligament and become attached to it, no pedicle exists. The treatment of these conditions will now be considered.

The pedicle is best dealt with in the following manner. The ovarian vessels are secured with strong catgut passed around the infundibulopelvic ligament by means of a long pedicle needle. Another ligature is introduced close to the uterus, underneath the tube, so as to secure the utero-ovarian ligament and upper part of the broad ligament.

The tumor is then cut away along with the Fallopian tube, the latter being partly dissected out of the uterine wall. The raw area thus left after removal is then buried in peritoneum by means of a continuous catgut suture.

The older method of ligating the pedicle *en masse* is not so satisfactory and should be abandoned.

Ovarian cysts which have developed within the broad ligament are mainly papillomatous. Sometimes this extraperitoneal development may be slight. In such a case, after the evacuation of the cyst, the pedicle may be secured by a series of interlacing ligatures passed under the cyst from the uterus to the infundibulopelvic ligament. In a more marked case, after evacuation of the intraperitoneal portion of the cyst, the peritoneum covering the extraperitoneal part is divided around its attachment and the tumor is enucleated.

In the most marked extraperitoneal cases the whole tumor lies under the peritoneum. As it grows it may come into relation with various structures of the pelvis, *e. g.*, rectum, bladder, uterus, etc.; and marked displacement of these may occur, as well as firm adhesions to them. In these cases before enucleation is attempted the ovarian vessels should be controlled in the infundibulopelvic ligament by means of a strong catgut suture passed with a needle. After evacuation of the cyst-contents its walls are pulled outward by means of forceps and its peritoneal covering is incised on the upper surface if the tumor be a pelvic one. If the cyst extend above the pelvis, the peritoneum is cut around the swelling near its base. The tumor is then rapidly enucleated by means of the fingers; in some cases, by knife or scissors. Where there is firm attachment to a delicate structure,—*e. g.*, bowel,—it may be necessary to leave behind a piece of the adherent outer portion of the cyst-wall, but none of the inner lining-membrane should be left. It should be pulled or scraped away. Care must be taken not to injure the ureter or any large vessel. The ureter is white in color; it may be distended somewhat in these cases.

There may be a good deal of bleeding as enucleation proceeds, but the preliminary ligation of the ovarian vessels tends to diminish this. The tube and broad ligament may be ligated close to the uterus at an early stage with advantage, care being taken not to include the ureter.

As vessels are torn through they must be caught with forceps and tied. Sometimes ligatures cannot be passed. The galvanocautery may be used, or the pressure of a hot sponge.

When the extraperitoneal tumor is entirely removed, the peritoneal sac should be closed by continuous catgut suture. It then lies in a crumpled mass at the side of the uterus. Sometimes when the uterus is too firmly attached to the tumor, its removal also may be necessary.

When the cyst develops in the folds of the mesentery, its separation may be accompanied with much bleeding. Ligatures must be carefully used, because too wide portions must not be constricted lest the nutrition of the gut should be interfered with.

When the cyst grows up behind the peritoneum in front of the pelvis and abdomen, the abdominal incision may not enter the peritoneal cavity at all. Usually, however, in such a case it must be opened before the cyst can be entirely enucleated. If the cyst can be removed, the remaining cavity should be stuffed with gauze and allowed to close gradually, being shut off from the peritoneal cavity.

Double Extraperitoneal Cysts.—These may be treated by a double procedure similar to that just described. Sometimes it is impossible to separate the uterus from the cysts, and its removal, along with that of the tumors, is necessary.

Incomplete Operation.—Both in the case of extraperitoneal and of intraperitoneal cysts which have become very adherent to the pouch of Douglas it may be impossible to remove the entire tumor.

In such cases the inner lining—the secreting surface—should be torn or scraped off, oozing of blood from the rest of the wall being checked as much as possible. If the remnant remaining be a small one, it may be left *in situ*. If it be large, its edges should be stitched to the edge of the lower part of the abdominal incision, the cavity being drained with chinosol gauze and allowed to close gradually.

In the case of the extraperitoneal cyst, an opening may be made into the vagina, drainage being carried out by means of a T-shaped rubber tube and by chinosol gauze. In such a case, the first incision into the sac is carefully closed before the abdominal wound is sutured.

In removing papillomatous and malignant growths care should be taken not to allow portions to escape into the peritoneum.

The presence of disseminated papillary growths in cases of the former tumors is not a contraindication to removal of the primary growth. They are not necessarily malignant, and may disappear afterward. Ascites is usually present in these cases, and Pozzi recommends drainage for a few days after operation. This is best carried out through an opening into the vagina. This author also advises that secondary operations be carried out if papillomatous masses develop after the primary procedure. This should not be done if clear evidence of malignancy exists.

Dermoid Cysts of the Ovary.—These should be removed *en masse*, and only by abdominal incision. Evacuation should not be attempted because of the risk of escape of its contents into the peritoneal cavity. The pedicle is secured just as in the case of simple cysts.

Solid Ovarian Tumors.—When these can be removed, whether simple or malignant, the procedure is the same as in the case of an ovarian cyst, save as regards the reduction of the size of the tumor.

Removal of a malignant growth need not be attempted when the disease infiltrates neighboring structures or when metastases exist elsewhere.

Ovarian Cysts Complicating Pregnancy.—In such a case the cyst should be removed by abdominal section, save when it is very small and above the pelvic brim. The procedure is the same as in the nonpregnant state. Care

should be taken to disturb the uterus as little as possible, not to puncture it, and not to mistake it for a cyst.

After the operation the patient must be kept under the influence of morphin or chloral for a few days in order to keep the uterus inactive. A strong silk elastic binder should be worn throughout the pregnancy, being adjusted from time to time.

The maternal mortality is very slight after this operation, and frequently pregnancy is not terminated. The older methods of dealing with these cases are responsible for an enormous death-rate. In Heilberg's statistics of 271 cases there was a maternal mortality of more than 25 per cent. and a fetal mortality of more than 66 per cent. In Williams' series of 461 cases the former was 25 per cent., the death-rate being as large in the easy as in the difficult cases; in cases requiring little or no help as in those needing the most skilful assistance. Few of the deaths occurred in pregnancy when not interfered with. One took place suddenly, probably from rupture of the cyst; five resulted from supuration of the cyst. The great majority of the deaths occurred at or after labor or in the puerperium, the largest percentage being after delivery. *The chief causes of death* are rupture of the cyst, septic infection, gangrene of the cyst-wall, hemorrhage, and peritonitis. Such a record is sufficient to discredit the various methods employed in the past—i. e., tapping the cyst, inducing abortion and labor, delivering by version, forceps, and craniotomy. *Removal of the cyst by abdominal section is the safest method.* If it cannot be removed without performing Cesarean section, the latter procedure should be as well carried out.

Gordon, in 1894, collected 176 cases of ovariectomy in pregnancy. Of these, 93.2 per cent. recovered. In 69 per cent. gestation continued to full term. He shows that in the most recent years the percentage of recoveries and of full-time labors is even greater. The most favorable results are obtained when the operation is performed in the first four months. Of 12 cases of double ovariectomy, all the women recovered but abortion occurred in 42 per cent. In 10 cases cysts of broad ligaments were removed, with 1 death and 6 abortions. Fehling has collected 266 cases, with a mortality of 5.4 per cent.; in 33 per cent. of cases the fetus was lost through abortion or premature labor.

Graefe has collected 175 cases, with a maternal mortality of 2.3 per cent.

Malignant Growth in the Abdominal Wall Following Removal of an Ovarian Tumor.—Various operators have reported such an occurrence. Halban divides the cases into three classes: 1. Removal of malignant growth followed by a malignant development in the parietes. 2. Removal of benign tumor followed by benign growth. 3. Removal of benign tumor followed by malignant growth. It is difficult to explain the last two groups. Possibly, in the reported cases, small malignant areas were present in the tumors which were supposed to be benign.

Such occurrences emphasize the importance of taking great care in the removal of ovarian growths.

CHAPTER XIII.

AFFECTIONS OF THE FALLOPIAN TUBES.

ABSENCE AND ANOMALIES OF STRUCTURE.

Both tubes may be congenitally absent; this is a very rare condition, being usually associated with rudimentary or absent uterus. Sometimes one tube may be absent; the ovary on this side may be well developed, rudimentary, or wanting; this condition may be associated with imperfect development of



Fig. 224.—Tube with accessory fimbriated opening.

the uterus on the corresponding side. The kidney of the same side may also be absent.

Occasionally, the tube is only partially developed. The outer end presents many variations as regards the size, shape, number, and development of the fimbriæ. The latter may be entirely absent; sometimes only a portion of the tube is patent, the rest retaining the original solid structure. The adult tube may occasionally present the convoluted form found in fetal life.

The tubes vary in length. Both may be abnormally long or short, or they may be unequal in length and size.

Supernumerary or double tubes are very rare. They have been found in the embryo by Nagel. Amann has seen them in the sheep.

Accessory tubes and ostia are not infrequent. Kossmann finds them in

4 to 10 per cent. of all cases. Usually one ostium is found on the upper part of the tube, not far from its outer end. Rarely more than one are found. They may be sessile or attached to short tubes, which rarely communicate with the tube lumen.

Kossmann states that little appendages with or without a ring of fimbriæ found near the tubes are also derived from the Müllerian duct. Ballantyne and Williams, however, believe that these may be developed from Kobelt's tubules and distinguishes them from true accessory ostia.

Sampson Handley believes that accessory ostia represent a persistent embryonic condition. In an early stage of the Müllerian duct there are three



Fig. 225.—Tube with three accessory fimbriated openings, one of which is pedunculated.

peritoneal invaginations or pronephric funnels. Ordinarily, the first two of these disappear, the third remaining as the hydatid of Morgagni. The latter is usually described as representing the upper end of the Müllerian duct. Handley, however, believes that the ovarian fimbria should be so described.

In exceptional cases the other two funnels, which are usually obliterated by secondary dehiscence of the duct from the top of the ovarian fimbria to the hydatid of Morgagni, may persist as accessory Fallopian tubes, serially homologous with the hydatid. Handley states that he has never seen remains of more than three pronephric funnels. Broad-ligament cysts may develop from these remains (see p. 290).

Diverticula of the tube lumen may sometimes be found, which may extend to the peritoneal covering. Very rarely longitudinal division of the lumen may be found so that more than one canal is produced.

Anomalies of Position.—Various displacements may be found. Some of these may be congenital in origin, but most are due to causes which develop in the adult state. The tube may be found in various hernias, being usually associated with the ovary.

Hypertrophy and Atrophy.—The tubes are usually somewhat enlarged in pregnancy. This may also be found with large fibroids. Large broad-ligament tumors may cause marked elongation of the tubes; this may also be found if they become adherent to any other growing tumor. Pressure of neighboring new-growths sometimes causes tubal atrophy. Adhesions may lead to thinning or even to division of a tube. Atrophy occurs after the menopause.

Subperitoneal Cysts.—Small cysts are occasionally found under the peritoneum surrounding the tube. Various views are held as to their origin. Some believe them to be derived from embryonic remains; others hold that they are formed from inclusion of peritoneum endothelium due to inflammation. Dickson states that they are distended lymph-spaces which have become obstructed.

INFLAMMATION OF THE TUBES (SALPINGITIS).

Etiology.—Inflammation of the tubes is due to direct infection with micro-organisms or to the spread of inflammation from neighboring structures which are infected.

Normally the tubes are free from germs. In inflammatory conditions various organisms have been discovered, especially when the affection is of recent origin. In long-standing cases they may not be found, having entirely disappeared.

The most frequent infecting organism is the gonococcus; less common are the tubercle bacillus, streptococcus and staphylococcus, colon bacillus, and pneumococcus. Mixed infections also occur, but to what extent cannot be definitely stated.

In 122 cases of purulent salpingitis Menge obtained the following findings:

In 47 organisms were found; in 75 they were not detected. Of the former series, a pure culture was obtained in 44, mixed in 3.

In 28 cases the gonococcus alone was found; in 9 the tubercle bacillus alone; in 1, a pyogenic staphylococcus; in 1, the colon bacillus alone; in 1, an anaërobic diplococcus.

It is interesting to note that the tubercle bacillus was next in frequency to the gonococcus. Apart from the direct influence of micro-organisms, tubal inflammation may also result from the action of their toxins, though to what extent this occurs is not certain.

Infection of the tubes may follow acute gonorrhea of the external genitals, or it may result from latent gonorrhea in the female or in the male, without the accompaniment of the ordinary signs and symptoms of acute gonorrhea. It may follow childbirth, abortion, or operative procedures on the genital tract or peritoneal cavity. It may occur in the course of the acute exanthemata.

It may spread from an infective process in neighboring structures. Rarely, salpingitis is due to actinomyces.

It is frequently stated that salpingitis may be due to chills, excessive coitus, or exercise during or near menstruation, but it is probable that, in cases related to these factors, the influence of bacteria cannot be excluded.

Pathology.—Salpingitis may be acute or chronic. The most important changes occur in the mucosa, but all parts of the wall may be found affected at the same time.

When the peritoneum covering the tube is affected, it may be a localized inflammation or part of a wider affection.

It leads to bending, stricture, displacement, or to adhesions of the tube to surrounding parts. Very frequently the inflammation spreads to the ovary also. It may close the outer end of the tube by uniting the fimbriæ together by pseudomembranes. When the muscular portion of the



Fig. 226. —Pyosalpinx ($\times 87$).

When the muscular portion of the wall is affected, it becomes thicker and hard, owing to the small-celled infiltration in it; when pus is present, small loculi may be formed throughout it.

When the mucosa is affected, various changes are produced. Round-cell infiltration and effusion of serum take place into the delicate fimbriæ and into the thin layer of submucous tissue. There is congestion of the vessels. Small hemorrhages are sometimes found. An increased mucous secretion takes place into the lumen, and it may contain leukocytes, shed epithelial cells, intact or breaking down, and, sometimes, red blood-corpuscles. The epithelial lining is lost in some parts, degenerated in others,



Fig. 227. —Catarrhal salpingitis ($\times 55$).

and adhesions may occur between neighboring plicæ.

Sometimes the fringes may enlarge and vegetations may form in connection with them. These

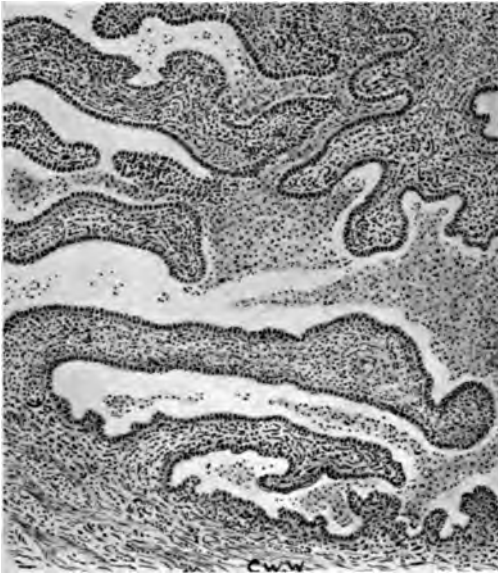


Fig. 228.—Pyosalpinx ($\times 55$).

appear like polyps or papillomata. The inflammation may go on to pus-formation. By far the most common cause of purulent salpingitis is the gonococcus. The organism may penetrate all layers of the wall. Bumm's view that only the superficial portion of the mucosa can be invaded is incorrect. In many cases of old-standing tubal disease of undoubted gonorrheal origin no organisms may be found, because they have died out or exist as involution forms which cannot be detected.

As a result of adhesions of the denuded mucosa, occlusion of the tube may be brought about in its continuity in one or more places,

but most often, as described, at the abdominal ostium. If fluid continues to be poured into the lumen, the tube becomes distended and the condition of hydrosalpinx or pyosalpinx is produced.

In the cases in which a slow chronic interstitial change is the main one, the tube may become very hard and somewhat thickened. In advanced stages an atrophy is sometimes produced as absorption occurs. The lumen may be obliterated partly or wholly by adhesion of the inner walls, and unobliterated portions may give rise to small cysts.

Hydrosalpinx.—This is a distended condition of the tube, the outer end or both outer and inner ends having been closed. Occasionally the distended portion may not involve the whole length of the tube. The peritoneal surfaces of the fimbriæ usually adhere as a result of peritonitis, the fimbriæ being more or less inverted. The condition may be unilateral or bilateral.

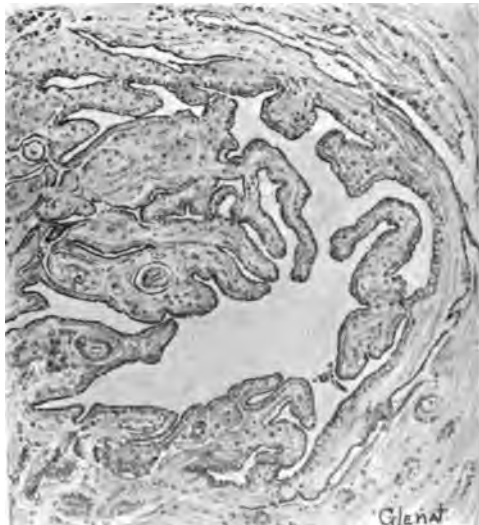


Fig. 229.—Chronic salpingitis ($\times 12$).

PLATE V.



This represents an enlarged and congested Fallopian tube with marked varicosity of the veins in its wall.

The tube becomes enlarged and elongated, tortuous, and pear-shaped, with constrictions. The diameter usually increases from the uterus outward. It rarely is larger than a small pear, though it may become so. The outer surface is smooth and whitish blue in color; the wall becomes thin and translucent; its thickness diminishes from the uterine end outward. There are often thin adhesions present. The fluid is citron-colored. Sometimes it contains flakes of lymph or a little blood. Its formed elements may consist of blood-corpuscles, epithelial cells, leukocytes, and, sometimes, cholesterin. Rarely, a calculus may be found. The cavity has usually one compartment, but may have more than one. In some cases the uterine end of the tube may not be completely closed, but only stenosed, so that fluid may escape through the uterus; this condition is termed "*hydrops tubæ profluens*." The mucosa becomes very thin as the tube distends. The plicæ persist a long time; as stretching of the tube occurs, the latter become low ridges. The epithelium

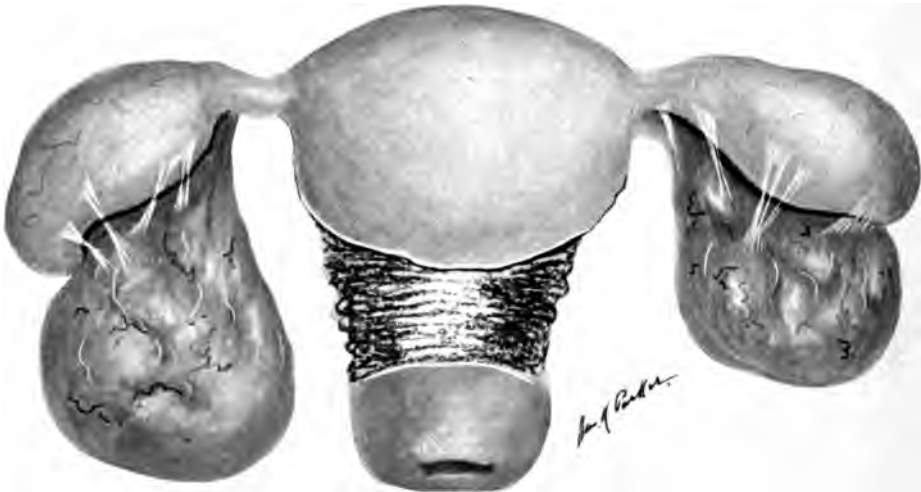


Fig. 230.—Bilateral pyosalpinx with chronic ovaritis.

persists on the plicæ longer than it does on the wall between them, where it gradually becomes flattened and disappears.

The muscular coat atrophies and becomes replaced by fibrous tissue. Hyaline degeneration takes place frequently. Rarely, calcareous plates are found in the wall. Sometimes the distended tube has a narrow pedicle, owing to rotation.

Various authorities believe that in some cases a hydrosalpinx is the advanced condition of a pyosalpinx, the purulent contents becoming transformed. Menge, Kleinhaus, and others believe that this is impossible, and state that the histologic appearances differ in the two conditions. A hydrosalpinx may undoubtedly be transformed into a pyosalpinx.

Some cases are due to the retention of fluid poured into the tube as the result of inflammation. In some cases distention may follow closure of the fimbriæ by peritonitis, the rest of the tube being healthy.

Clement White states that in many cases there is an impervious condition

of the outer end, due to faulty development. He points out that frequently there is no previous history of salpingitis. Sometimes the tube may be distended as the result of edema in advanced nephritis.

Sometimes a hydrosalpinx may communicate with a cyst in the ovary—tubo-ovarian cyst. These may reach a considerable size. The ovarian portion may be a simple cyst or may be multilocular and proliferating.

Pyosalpinx.—This is a distention of the tube as a result of purulent salpingitis. The distention may be uniform, but generally the wall is somewhat constricted in parts. It may be produced quickly, as the result of an acute inflammation or as a chronic process. Sometimes a hydrosalpinx may become purulent. The least alteration is found near the uterus. In extreme cases the enlargement of the tube may reach the size of a child's head. It may extend into the abdomen. The wall is bluish-white and varies in thickness at different points. Adhesions are found attached to various structures. The lumen may be single or partly divided into compartments. The mucosal



Fig. 231.—Hydrosalpinx adherent to ovary, enlarged by chronic inflammation.

fringes are more or less obliterated, and the surface has the ordinary appearance of an abscess cavity. The pus is generally thick and yellow. In old cases it may become a thin fluid, with masses of lymph and pus floating in it. It has a fetid odor when the sac is adherent to the bowel. On microscopic examination, the wall is found to be lined with mucosa altered by inflammation. The lining epithelium is mainly absent, but may be found somewhat altered, especially in depressions in the mucosa. Gas is rarely found in a diseased tube.

The fimbriated end is rarely free. Generally the fimbriae are matted together, or adherent to the ovary or to some part of the peritoneum. The peritoneal covering of the tube may be considerably thickened.

When both tubes are affected, the left is usually larger than the right.

The muscular part of the wall thins as distention occurs, but thickenings may be brought about by inflammatory infiltration. A pyosalpinx may rupture into the peritoneal cavity, setting up severe peritonitis. It may also open into the rectum, especially when on the left side. Sometimes it may rupture into the bladder or vagina, or even through the anterior abdominal wall. It

may also burst into the peritoneal cavity and be circumscribed by surrounding adhesions or less often into the general cavity, with diffuse peritonitis and death.

It has been noted that pyosalpinx and hydrosalpinx occur in a certain percentage of cases of carcinoma uteri.

Sometimes the ovary is infected from the tube, and an abscess formed in it which communicates with the pyosalpinx, forming the condition of *tubo-ovarian abscess*. The communication may take place by the outer ostium of the tube, or this may be closed and an opening in the continuity of the tube communicate with the cavity in the adherent ovary. Occasionally the ovary



Fig. 232.—Large tubo-ovarian abscess.

may be the seat of a cystic neoplasm, which may lead to the continued growth of the swelling. The tubo-ovarian abscess may burst into the peritoneum or may open into the rectum. In the latter case it is usually the ovary which makes the communication.

Symptoms.—It is impossible to present a clear account of the symptomatology of salpingitis, especially in relation to the different varieties. In acute cases, and very often in chronic cases, there are inflammatory changes in the neighboring ovary, uterus, peritoneum, or connective tissue, so that there is

difficulty in assigning to each part its proper share of symptoms; pain is felt in the side affected.

Indeed, the symptoms are very similar to those described in connection with ovaritis or pelvic peritonitis (see pp. 269, 365). The acute stage may last a week or more. Pain and fever may be intermittent or constant. They are often aggravated by exertion, menstruation, or coitus. Menorrhagia and often metrorrhagia may occur, and if the disease is bilateral, sterility. In chronic purulent salpingitis acute exacerbations may sometimes develop, and may be caused by the escape of small quantities of pus setting up a



Fig. 233.—Section of tubo-ovarian abscess. The fimbriated end of the tube communicates with the ovarian abscess cavity.

localized peritonitis. Again, in some cases where large distentions of the tubes are formed, there are often very few symptoms. There may be a period of quiescence and apparent improvement after a stage of activity. It is possible that this may be due to the sterilization of the tube-contents, whereby the fluid loses its virulence. Symptoms may, however, be caused by pressure of the distended tubes against the bowel or bladder, especially when fixed by adhesions, *e. g.*, constipation, distress on moving the bowels, frequency of micturition, dysuria. Backache and a bearing-down feeling are common.

Some cases of hydrosalpinx may exist for years without causing symptoms. In many of these cases reflex disturbances are established and various neurotic phenomena may become marked. The patient may become unfit for her duties and more or less invalided.

Frequently cases are found in which the tubes are much altered as the result of a long-standing inflammation, though little or no impairment of health exists.

If a distended tube ruptures into the peritoneal cavity, unless it is circumscribed, severe acute peritonitis may follow, though in some few cases, owing to the sterile nature of the contents, peritonitis does not occur. If rupture occurs into the rectum, the symptoms generally improve.

Physical Signs.—Where there is considerable involvement of the surrounding peritoneum, and the tube is not markedly enlarged, it is usually impossible to distinguish the tube from neighboring structures.



Fig. 234.—Hydrosalpinx (\times about $7\frac{1}{2}$).

If the tube only is thickened, it may be readily palpated on bimanual examination, which usually causes the patient much pain, while if the ovary is also affected, it may be difficult to distinguish it from the tube, both being blended by adhesions.

Sometimes a tube containing fluid may not be recognizable to the fingers on bimanual examination because the sac is not sufficiently tense. The fingers of both hands may compress the swelling and yet not detect its presence. Fluctuation may sometimes be appreciable.

In the case of *hydrops profluens* there may take place an occasional discharge of fluid through the uterus when the swelling present at a previous examination has disappeared.

When a tube is very much distended, it may sometimes be palpated through the lower abdominal wall. Generally it is best made out on bimanual ex-

amination, at the side of the uterus, behind it, or sometimes in front of it. There is usually tenderness felt by the patient. The examination is often best made by the abdominorectal method. The most satisfactory result is obtained when anesthesia is employed. In making an examination great care should be taken lest the tube be ruptured.

Differential Diagnosis.—(See p. 279.)

Prognosis.—Tubal infection rarely leads to a wide-spread infection of the peritoneum. Many cases of slight catarrhal salpingitis and even purulent salpingitis gradually improve, health being restored, the function of the tubes being unimpaired. When suppuration is marked or the muscular coats thickened by the formation of new connective tissue, or perisalpingitis is prominent, there is more likely to be chronic ill health and impairment of tubal function. The most virulent infections are usually caused by organisms

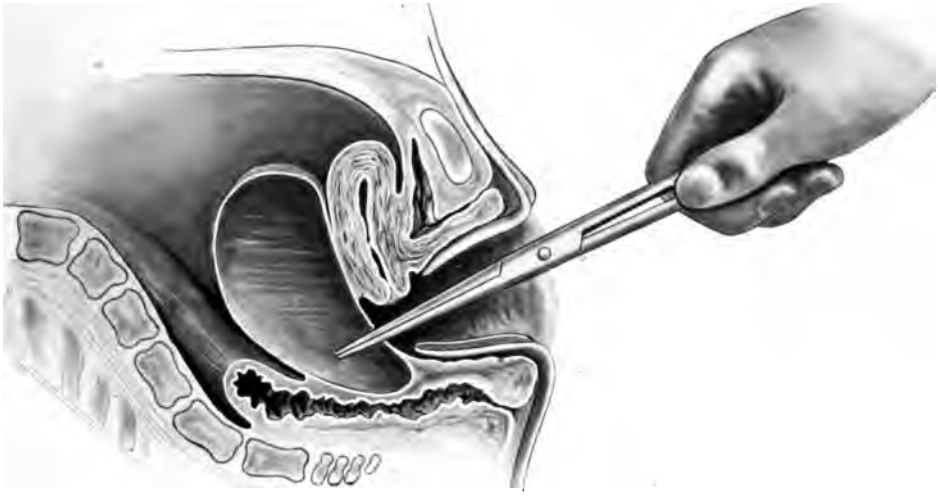


Fig. 235.—Opening of a tubal abscess situated in the pouch of Douglas.

other than the gonococcus. The latter, however, is more persistent than the others, and more apt to lead to recurrent attacks of inflammation.

Chronic invalidism is, therefore, more usually associated with gonococcus infection. A hydrosalpinx, if large, may cause pressure disturbances, but frequently it may not be associated with much disturbance of health. The same may be said of a pyosalpinx, but this condition is more serious because of the tendency of the sac to be intimately adherent to other important structures, *e. g.*, bowel, bladder, and of the pus to burrow.

Treatment in Acute Cases.—The treatment in an acute attack is the same as that described in connection with acute pelvic peritonitis and ovaritis (p. 366).

Operative interference is rarely indicated. Abdominal or vaginal section for the removal of the tubes in the stage of acute infection is very liable to lead to infection of the general peritoneum and consequently increases the danger to the patient.

Only when there is evidence of general peritonitis should abdominal section be performed for the purpose of removing the infected tubes and of dealing with the peritonitis.

If, in association with an acute attack, one or both tubes are found much distended, it is advisable to incise and drain them. More radical measures should never be undertaken until the case has become chronic and the infectivity of the tubal contents greatly diminished. Occasionally, after mere drainage, the patient may entirely recover good health.

Methods of Drainage.—By *Vaginal Incision*.—This method should be selected whenever it is feasible, and in the great majority of cases it may be adopted, for the distended tube usually lies posterior to the broad ligament or uterus and tends to bulge downward.

The patient is placed in the lithotomy position and carefully prepared. General anesthesia may be used if there be no contraindication, but frequently the operation may be carried out without any anesthesia or with the injection of cocain solution in the area of the vaginal wall to be incised. Local anesthesia is always preferable if the patient's general condition be much weakened.

After careful bimanual examination for the purpose of outlining the swelling the vagina is exposed with a spatular speculum and retractors. As a preliminary to the operation it is advisable to swab out the uterine cavity with pure formalin or phenol.

The posterior lip of the cervix is then grasped with a bullet-forceps and held by an assistant.

A transverse incision through the vaginal mucosa is then made in the posterior fornix and enlarged by stretching with the fingers. If there is any doubt as to the nature of the swelling, an exploring needle may be pushed into it, suction being made by an attached syringe. The mass is then punctured with a director or artery forceps, and as the fluid escapes the hole is enlarged by opening the forceps. If the other tube is distended and in the pouch of Douglas, it is opened in a similar manner.

Sometimes, after making the incision of the vaginal mucosa, it is more convenient to remove the speculum and retractors and to perforate the tubal swelling with a curved director carried along the palmar aspect of the index and middle fingers.

The tubal sac should be washed out with saline solution containing forma-



Fig. 236.—Gauze placed in abscess cavity after incision.

lin (30 drops to a pint). Then either a T-shaped rubber tube or a strip of antiseptic gauze should be introduced. If the tube is used, the lower end may project through the vulva, which should be covered with gauze dressing. Thereafter, daily irrigation of the cavity with the saline formalin solution may be carried out through the tube for two or three weeks.

If gauze is used, it should be renewed every two days for a couple of weeks, after which period daily irrigation may be carried out. The vaginal wound tends to shrink, and unless care be taken to keep it patent, there may be a reaccumulation of pus in the tubal sac and symptoms of infection may develop.

On this account the rubber tube is probably more satisfactory than the gauze drain.

Occasionally after this operation a tubal fistula may remain. A. Martin has reported a case in which, after vaginal extirpation of the uterus, pregnancy has occurred in a fistulous tube.

By Abdominal Incision.—Drainage by this route is rarely necessary, and only when there is a marked enlargement of the tube, which lies above the broad ligament or uterus, attached to the abdominal wall, and there is some marked contraindication to its complete removal. The incision is made in the middle line or in the inguinal region, according to the position of the abscess.

This method is less satisfactory than vaginal drainage, as the closure of the cavity is apt to be very prolonged.

A permanent tubal fistula has frequently remained after this procedure.

By Rectal Incision.—This method, formerly considerably employed, in the case of a large pyosalpinx bulging against the rectum in the pouch of Douglas must never be adopted save where a small opening has already formed, too small to allow of free drainage. To perform this operation most satisfactorily the patient should be placed in the elevated lithotomy position (see pp. 164, 165). The anus is distended with a speculum and the opening into the tube exposed. The latter may be enlarged with a bistoury in the long axis of the bowel. A T-shaped rubber tube is then introduced through the anus into the tubal sac.

When no communication exists between the rectum and the tube, rectal incision should not be employed, the vaginal opening being more satisfactory. It must always be remembered that extensive operative measures may be necessary at a later period, and if rectal incision has been carried out, the complications and risks are much greater than if vaginal incision has been employed.

Treatment in Chronic Salpingitis.—The hygienic, medicinal, and local measures to be adopted in these cases are similar to those described in connection with chronic pelvic peritonitis and ovaritis (pp. 272, 368). In many instances these are ineffectual and recourse to surgical interference is necessary.

It is difficult at the present time to give definite indications as to the kind of operation which is best suited to different varieties of salpingitis. In the past undoubtedly complete removal has been carried out in too large a percentage of cases, and various workers have recently been endeavoring to widen the sphere of conservative measures, especially in women in the early child-bearing age.

Though some success has attended these efforts, the work cannot as yet be said to have advanced beyond the experimental stage. In performing resection of a closed tube it is impossible to be absolutely certain that the lumen is sterile and that no fresh infection may follow the operation. Neither is it certain that the opening which is established will not close again, nor that the patient may not suffer from pain and other symptoms. Ill success in connection with conservative measures may, therefore, necessitate second operations, a prospect which is not pleasing to the majority of women. It is advisable that in all cases in which conservative operations are contemplated the nature of the procedure and the results should be carefully explained to the patient.

Minor Surgical Measures.—In many cases in which a tube is bound down by old perisalpingitis it is sufficient to free it from the adhesions and to cauterize the raw areas so as to form a char. If the tube tends to fall below the



Robert V. Keith

Fig. 237.—Appearance of tube after resection.

pelvic brim, it is advisable to stitch the infundibulopelvic ligament to the parietal peritoneum above the brim in order to prevent this tendency. This procedure may be carried out even if there be slight thickening of the tube-wall. When, however, the fimbriated end is buried in adhesions, it may be so extensively rawed by being made free that it is certain again to become adherent, even if cauterization be carried out. In such a condition removal of the entire tube or resection of the outer end should be practised.

Resection of the Tube.—This procedure must never be carried out if any indications exist pointing to an active infective process, *e. g.*, elevation of pulse and temperature, leukocytosis. There should not have been any history suggesting infection within, at least, six months. If the tube contain pus, the operation is not advisable unless tubal distention has been known to exist for many months. Bacteriologic tests of the tube contents are alone capable of determining their sterility, but, unfortunately, these cannot be made in the

progress of an operation, though, of course, slides may be examined to determine whether or not germs are present. Yet negative results are not conclusive proof of sterility. If the inner end of the tube be much thickened, the lumen is not likely to be of sufficient caliber to insure the passage of an ovum, even though resection be performed, and such a condition should be regarded as a contraindication to the operation.

In all cases in which resection is contemplated the condition of both tubes should be carefully studied. If one be perfectly normal, the opposite diseased tube should be removed rather than resected, for it is better that the woman should be left in good health with one healthy tube than to be subjected to the uncertainties attendant on resection. In the late child-bearing period or after the climacteric the latter operation should not be performed. In hydrosalpinx and hematosalpinx there is practically no risk from infection in performing resection. Neither is there much when the fimbriated end is buried in adhesions, the tube not being thickened or distended or its lumen closed.

T e c h n i c .—In most cases the outer portion of the tube is removed by an oblique incision made with scissors, the amount varying according to the conditions. If the opening is small, it may be somewhat enlarged by dividing the wall longitudinally on the upper side.

A series of interrupted fine catgut sutures are then introduced around the opening, so as to approximate the mucosa and peritoneal covering. The tube-lumen is then swabbed out with formalin saline solution (30 drops to a pint). The edges of the mesosalpinx from which the outer part of the tube has been removed should be closed with a continuous catgut suture.

It is the author's practice after performing tubal resection to introduce chinosol gauze into the pelvic cavity, its end being carried into the vagina through an opening made below the cervix. This is removed in three or four days. It is a precaution in view of the possibility of the occurrence of infection from the opened tube.

The results of tubal resection have been far less satisfactory than those following ovarian resection. Adhesions are very apt to form about the newly made ostium. Several cases of infection of the peritoneum have been reported. While pregnancy has certainly taken place after the operation, it has been reported in a very small percentage of cases. A second operation for the removal of a diseased tube, previously resected, may be necessary in some instances.

Salpingectomy.—Removal of a diseased tube is carried out both by the abdominal and vaginal route. The latter should be rarely employed, because it does not afford scope for thorough examination of the pelvis nor for such a thorough and careful technic as does the abdominal route. When raw areas are made by the separation of adhesions, they cannot be satisfactorily dealt with through a vaginal incision. When the tube is much enlarged, high in the pelvis, or when adhesions are extensive, the vaginal route should not be selected.

(a) *By Abdominal Section.*—The abdomen is opened by the ordinary suprapubic mesial incision and the relationships of the pelvic viscera carefully studied. Frequently the omentum is adherent to the parietes or to the pelvic viscera. It should be separated and dealt with as described on p. 229. Bowel adhesions must be very carefully separated. The pelvis should

then be explored. If slight adhesions only surround the tube, they may readily be broken down with the fingers so that the broad ligament and tube may be raised.

During these procedures it is advisable that the patient be in the Trendelenburg position, and that a series of pads be placed in the peritoneal cavity just above the pelvis.



Fig. 238.—Diagram illustrating first stage in removing the appendages by abdominal operation. A catgut ligature has been placed around a section of the broad ligament, including the utero-ovarian ligament under the tube. The needle is represented as carrying a piece of catgut through the infundibulopelvic ligament beneath the ovarian vessels.

When adhesions are extensive or firm, they should be divided under observation; otherwise there is risk of injuring important structures, such as bowel. They may be divided with the fingers, with a piece of gauze, or cut with knife or scissors. Long adhesions may be tied with catgut before division. Sometimes when there is close union between bowel and tube, separation is not possible and it is necessary to shave off a portion of the tube-wall, leaving it attached to the bowel rather than to run the risk of injuring the latter.

The infundibulopelvic ligament with the ovarian vessels may be ligated as soon as accessible. When the tube is distended, it is usually possible to remove the mass without rupturing it. When it is very large, it is advisable to aspirate the contents and to close the opening with forceps during the rest of the procedure.

The tube may be cut away from the broad ligament from without inward or from within outward, bleeding points in the ligament being controlled with forceps. It is important that a portion of the uterine end of the tube should be dissected out of the uterus with a knife. Where there is doubt as to the sterility of the tube-lumen, the end of the latter remaining in the uterine wall should be cauterized.

In cases in which the outer part of the tube is deeply adherent in the pelvis, the bowel being implicated, it is usually most convenient to separate the tube from the uterine end outward so as to be able to manipulate the outer part more satisfactorily.

After removal of the tube the raw edge of the broad ligament and uterus should be covered with catgut sutures; bleeding points are controlled in this way.

When both tubes are diseased and fixed by adhesions, it is best to carry out separation of the latter on each side rather than to free one tube and remove it before touching the other. When the latter method is adopted, there is always danger of loosening the first applied sutures or ligatures by the manipulations necessary in dividing adhesions on the opposite side.

The ovaries in such cases are very frequently involved in the diseased process, and are dealt with in various ways according to the conditions found. The various procedures are cauterization of raw areas on the surface, ignipuncture, removal (see p. 371). When the ovaries are extensively diseased, they should be removed with the tubes. This operation is termed *salpingo-oöphorectomy*.

In all cases great care should be taken to cover denuded areas with peritoneum or to char them with the cautery in order to diminish the risk of after-development of adhesions.

Drainage is very rarely necessary. The author uses it only when the tube is considerably torn during its removal, when a portion of it may be left attached to a portion of bowel, when the tube contents have escaped into the pelvis, especially in cases in which much raw tissue has been left after separation of adhesions.

In all cases drainage is carried out by the vagina, which is opened below the cervix. (In all cases in which drainage may be necessary, the abdominal operation should be preceded by thorough cleansing of the vagina, after which it is firmly packed with gauze.)

The upper end of the strip of chinosol gauze previously inserted into the vagina is tied to a fresh piece, the knot being placed in the vagina. The pelvic cavity is then loosely packed. The abdomen is then closed.

(b) By Vaginal Section.—Removal of diseased tubes and ovaries may sometimes be satisfactorily accomplished by colpotomy, anterior or posterior, especially the former. The injudicious advocacy of this method by various operators within recent years has led to much unsatisfactory and bungling work. In certain selected cases vaginal removal may be fairly easy.

In many cases it is difficult and hazardous to the patient. The operator cannot estimate accurately the extent, nature, or situation of adhesions, and is forced to divide them without seeing them. In suppurative cases the appendix or bowel may be easily injured and the operator be ignorant of the accident. Even if the diseased parts are successfully removed, extensive raw areas may be left which are certain to give rise to adhesions, for they cannot in any way be covered.

To advocate the vaginal route for the reason of the increased safety to patients is nonsensical. In all complicated cases the abdominal operation is far safer and more satisfactory, for all the tissues may be inspected, bowel and appendix complications may be dealt with, and raw areas may be covered to a considerable extent. Within recent years the author has entirely abandoned vaginal salpingectomy or oöphorosalingectomy in infective disease of the uterine appendages.

Panhysterectomy.—In recent years, owing to the influence of the French school, operators in various countries have been advocating the removal of the uterus and appendages in cases of extensive infection, especially associated with suppuration, rather than merely removing the tubes and ovaries.

The complete procedure is undoubtedly a distinct improvement, especially in cases of extensive gonococcus infection. An enlarged infected uterus may frequently give rise to pelvic pain or distress and persistent leukorrhea after the removal of the appendages, especially if it be adherent or displaced. In cases, therefore, in which the organ must be freed from many adhesions, so that a large area of its surface is denuded, there should be no hesitation in removing it when double salpingo-oöphorectomy is contemplated.

The operation has been carried out both by the vaginal and the abdominal route, the former being chiefly favored in France, and there is at the present time some differences of opinion as to their relative merits.

The author strongly urges the employment of the abdominal method in the great majority of cases, for the reason that it allows the field of operation to be thoroughly inspected, bowel, appendix, and other complications to be openly dealt with, and denuded surfaces to be covered to a considerable extent. In complicated cases the vaginal method increases the risks to the patient, because the field of operation cannot be inspected, necessitating the carrying out of many manipulations by the sense of touch alone. Where extensive adhesions are separated, constant oozing of blood further helps to obscure the field of vision and to prolong and complicate the operation.

Pryor, a strong advocate of the vaginal operation, admits that intestinal complications are a contraindication. He is quite right, but, unfortunately, neither he nor anybody else is able with any degree of accuracy to diagnose appendiceal or intestinal complications before operation. Taking all cases into consideration, the abdominal route must be regarded as surest and safest, and as favoring the most exact surgical manipulations.

Abdominal Panhysterectomy.—The patient is placed in the Trendelenburg position and the abdomen opened. After placing gauze pads in the cavity so as to form a barrier above the pelvic brim, the uterus and appendages are carefully separated from all adhesions.

In some cases it may be very difficult to separate these structures without injuring important parts, *e. g.*, intestine, ureter, bladder, vessels. Careful

measures should be taken to repair these injuries immediately. Kelly recommends bisection of the uterus in order to gain additional space in removing the diseased adnexa when there are complicated adhesions. If this procedure be carried out, the uterus should have been thoroughly curetted and swabbed out with a strong antiseptic previous to the abdominal operation. The author has rarely ever practised this method of bisection, but he has sometimes found it advisable to remove the uterus before dissecting out the appendages.

Each infundibulopelvic ligament, containing the ovarian vessels, is ligated with catgut. Each round ligament is ligated and divided internal to the ligature. Each broad ligament is then divided transversely from the infundibulopelvic ligament to the uterus below the utero-ovarian ligament. Forceps are applied above the incision close to the uterus to check bleeding.

The incision is then carried across the front of the uterus, dividing the peritoneal layer above the bladder. The bladder is then dissected downward from the cervix and upper part of the anterior vaginal wall. The uterine vessels are then exposed and securely ligated with catgut close to the uterus. The broad ligament is then cut away from the uterus below the level of the uterine artery. The anterior vaginal wall is then opened close to the cervix (previous to the abdominal section, the vagina has been cleansed and a strip of gauze inserted in it), and the incision is carried around the fornix close to the uterus. The latter, with the appendages, is then removed. Bleeding points on the divided vaginal wall are then secured with fine catgut.

The peritoneum above the bladder is then stitched to the anterior vaginal wall with a continuous catgut suture. The end of each round ligament is drawn down and stitched to the side of the vaginal incision. The raw edges of the broad ligaments are covered with continuous catgut, and finally the anterior vaginal wall is stitched to the posterior wall, the peritoneum above the bladder being fastened to that behind the posterior vaginal wall. Raw areas in the pelvis are then covered with peritoneum or cauterized.

When drainage is deemed necessary, the vaginal opening is not completely closed and chinosol gauze is placed in the pelvic cavity, its lower end being carried into the vagina.

Vaginal Panhysterectomy.—The method is similar to that described on p. 572. The greatest care must be exercised in separating adhesions. When it is impossible to bring down the fundus uteri through the anterior opening in the peritoneum, the anterior wall of the uterus may be divided, and the posterior as well if necessary. As soon as the uterine cavity is exposed, it should be thoroughly cauterized or swabbed with pure formalin. The uterine vessels should be ligated before the delivery of the uterus, so that the lower ends of the broad ligaments may be separated from the latter.

The upper parts of the ligaments are secured with clamps in order that the uterus may be cut away.

The appendages are then dealt with separately. They must be carefully separated from adhesions so that they may be drawn down. If the ovary or tube is distended, aspiration may be necessary to facilitate the manipulations.

The ovarian vessels are ligated external to the tube and ovary on each side, and the appendages are then removed. (Sometimes, ligatures cannot be satis-

factorily placed and clamps may require to be used, being removed in a day or two.) The stump of each broad ligament is then stitched into each lateral fornix. When there is much oozing of blood in the pelvic cavity as the result of the separation of adhesions, the vaginal opening should be left partially open so that the upper end of the strip of gauze which is placed in the vagina may be introduced for a short distance into the pelvic cavity to serve as a drain. In three days the gauze is removed and vaginal antiseptic douches thereafter given daily.

Sometimes an operator finds, after commencing this operation, that the complications are too marked to permit him to continue without great risk to the patient. It is then necessary to complete the operation by the abdominal route.

HEMORRHAGE INTO THE TUBE.

Small hemorrhages may take place in acute febrile conditions, *e. g.*, typhus, in purpura, in heart, renal, and hepatic diseases. These are of no practical importance. Occasionally in normal menstruation a small amount of blood may be found in the tubes.

Hematosalpinx.—*Etiology.*—Distention of the tube with blood may take place as a result of atresia in the uterus or vagina. It is believed by many to be a reflux of the menstrual discharge from the uterus. The nearer the tube the atresia, the sooner is the hematosalpinx formed. In hymeneal atresia the condition is rarely observed (Bandl). Some think that the blood is derived from the congested mucosa of the tubes. In these cases the tubes are usually unequally distended—sometimes only one is affected.

Against the reflux theory is the fact that often the inner end of the tube may be completely closed off from the uterine cavity.

Hematosalpinx may develop in connection with the rudimentary horn of a malformed uterus, or in the case of a bicornute uterus where atresia exists on one side. Twists in the tube, thrombosis, or traumatism may cause the condition. Sometimes blood may be poured into a hydrosalpinx or pyosalpinx. It often forms in connection with a tubal pregnancy.

Pathology.—Small amounts of blood may be absorbed. If the tube distends, the wall gets thinner, though it may be thickened in places by inflammatory changes, which usually take place on the outside, leading to adhesions. The blood remains fluid for a long time, probably owing to its mixture with the tubal secretion. After a time it is a dirty brown fluid. Rupture may take place into the peritoneal cavity, or into structures with which it is adherent. Rarely gangrene of the sac or suppuration of the contents takes place.

Hemorrhagic areas may be found in the substance of the wall. The inner surface of the wall is usually covered with blood-pigment.

In the cases in which tubal pregnancy is the cause, the ovum may be entirely broken up and diffused through the blood, or it may be partly or entirely detached and become incorporated with the blood-mass to form a mole. The amount of blood extravasated varies in these cases. Often there is a tendency for the mass to increase, owing to fresh hemorrhages succeeding the primary loss. Sometimes the blood may be limited to the decidua and chorion, and may be so great as to compress and almost close the amniotic cavity, the fetus being partly or entirely destroyed.

In the early stages of these changes the ovum looks like a fresh blood-clot, and unless the specimen be studied with care, the distinctive gestation tissues, *e. g.*, amnion, chorionic villi, and decidua, may not be recognized. Later, the mass becomes paler and firmer, undergoing the ordinary changes of blood-clot. They tend to shrink in size, but may remain as small hard masses for long periods. It is important to note that in a certain number of these cases, where the clinical evidence points strongly to ectopic pregnancy, the most thorough examination of the tubal contents may fail to reveal corroborative evidence.

Diagnosis.—There is nothing distinctive in the symptomatology of hematosalpinx, it is so often associated with other conditions. The physical examination gives the same results as in the case of pyosalpinx and hydrosalpinx. The enlargement is the same as these.

Treatment.—The same as for hydrosalpinx and pyosalpinx.

TUBERCULOSIS OF THE TUBES.

The tubes are the most common seat of tuberculosis in the female genitals. In 172 cases collected by Merletti they were involved in 157 cases. In 62



Fig. 239.—Genital tuberculosis. The tube is distended with fluid and many tubercles are seen.

cases reported by Berkeley they were infected in 80.6 per cent. Very frequently it is associated with similar disease in the ovaries, uterus, vagina, or neighboring peritoneum.

Williams, in 1892, pointed out that the tubes are more frequently affected than is generally suspected, cases of salpingitis being often regarded as non-tuberculous whose true nature has been established by microscopic examination.

Tubal tuberculosis is generally secondary to the disease elsewhere, though it is usually primary as regards the genitalia. Sometimes it is primary as regards the whole body.

The disease is usually bilateral, but may be more advanced on one side

than on the other. The disease is found in the acute miliary, chronic diffuse, and chronic fibroid forms.

The tube is enlarged, adhesions are present, and characteristic nodules may be found on the surface. In slighter cases the tubes may not be much thickened and the tubercles may not be numerous. These are most numerous toward the outer end of the tube, especially where there is phthisis or a peritoneal affection.

Sometimes there is a single nodular enlargement, formed of several tubercles. Sometimes the tuberculous trouble may be so slight that it may be missed on ordinary microscopic examination. Sometimes there may be a condition of tubo-ovarian abscess.

In the cases in which the disease is primary in the tubes, it may be found localized there, and though there be surrounding peritonitis, this may be nontuberculous. The outer end of the tube may be closed and the lumen distended. It may contain a milky fluid or thick, caseous material, in which calcification may be found. The tubes are often sausage-shaped, but may present several large nodulations. The inner wall in well-marked cases resembles the lining of tuberculous cavities found elsewhere in the body, being irregularly ragged and studded with tubercles.

The muscular part of the wall is only occasionally invaded; ordinarily it is merely thickened by small-cell infiltration. In some cases the tube has a firm consistence; in others it is cystic.

Sometimes gonococcus infection may be found in these cases. A tuberculous tube may open into the bowel, bladder, or elsewhere.

It has been pointed out by various workers that adenomatous change may develop in connection with tubal tuberculosis, the disease appearing to stimulate growth in the epithelial structures.

Diagnosis.—The symptoms and signs vary as much as in the case of nontuberculous salpingitis. Except in cases where there is an acute infective attack due to other organisms, the disease usually progresses slowly and insidiously. In the majority of cases, in the absence of tuberculosis elsewhere or of a marked family history of the disease, the disease is not often diagnosed with certainty.

Treatment.—*Prophylactic.*—As tubercle bacilli may enter by the vagina, physicians and nurses should make digital examinations in the most cleanly fashion. Women should not sleep near a source of tubercular infection, and should avoid coitus with diseased men.

General.—If the case be one of wide-spread tuberculosis, the treatment is directed toward the general condition.

Operative.—Diseased tubes should be removed, even if the peritoneum be widely involved or if the lungs be slightly affected. If the latter be markedly diseased, operation on the genitals is not advisable.

The uterus need not be removed unless it be much enlarged; when it is slightly affected, curetage and the application of formalin to the cavity may be employed.

HYDATID DISEASE OF THE TUBES.

This is very rare as a primary condition. Eden has recently reported a case, but has been able to find only one other specimen described in literature.

ACTINOMYCOSIS OF THE TUBES.

This may be primary and due to infection from without, or may be secondary to the affection elsewhere. The tube becomes enlarged and adherent to surrounding structures. Nodules of the growth are found in the wall and the lumen of the tube becomes distended with pus. Secondary abscesses may result from the tubal condition.

NEW-GROWTHS OF THE TUBES.

Carcinoma.—This is sometimes primary. Doran described two varieties:

1. That developing in a normally formed tube.
2. That developing in a tube whose ostium ends in a cyst.

It arises in the mucosa, and may be of the papillomatous or adenomatous type. Doran believes that it may develop from remains of the Wolffian duct. It is mostly found on one side. It may lead to closure of the outer end of the tube. The growth is usually rapid. Inflammatory changes may be present.

Le Count states that tubes thickened and closed by inflammation may develop benign growths, which must be regarded as simple hyperplasia of the mucosa; they may sometimes become malignant. Doran and Macrez hold similar views. Stoltz and Eckardt consider that the importance of inflammation as a primary stage is much overestimated. Daniel, of Lille, thinks that salpingitis is but a predisposing cause, diminishing local resistance to infection.

Secondary infection may be due to direct spread from ovarian cancer in about one-third of cases, and from uterine cancer in two-thirds. It may appear in the mucosa or in the outer part of the wall first.

The cancerous masses may be found in nodules or diffused.

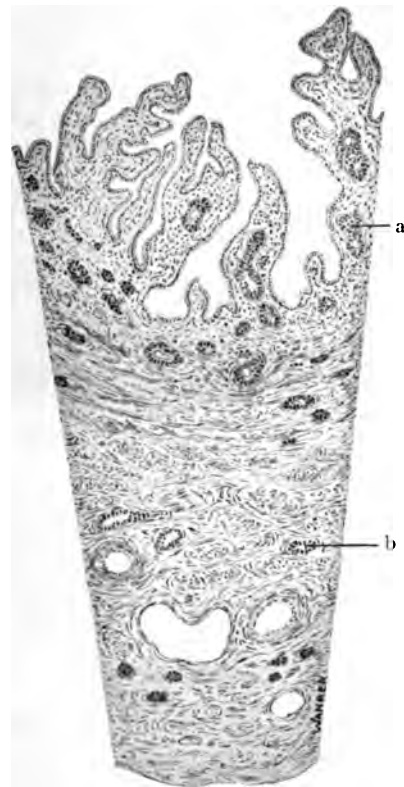


Fig. 240.—Adenocarcinoma of the fallopian tube which has extended from the uterus: a, Mucosa; b, muscular wall.

Diagnosis.—At first the symptoms may in no way be distinguishable from those of salpingitis. There may be early menstrual disturbances, but these may be absent. Pain is usually marked; it may be cramp-like, associated with the escape of a sanious watery discharge mixed with mucus. The disease has rarely been diagnosed in the early stages.

The prognosis is very unfavorable.

Extirpation should be carried out by the abdominal route, the uterus, appendages, ligaments, and all accessible pelvic glands being removed. Later, however, ascites and cachexia usually develop.

Sarcoma.—This is very rare indeed as a primary condition. It may form a diffuse mass or a series of projections in the tube. Sometimes sarcoma may spread from the uterus along the tubes.

Papilloma.—Benign papilloma is very rare.

Cystoma.—Small cysts are sometimes found under the peritoneum covering the tube. They may be of inflammatory origin.

Adenoma; Adenomyomata.—Occasionally, these growths may develop in the uterine portion of the tube-wall, some being probably derived from remains of the Wolffian body, others from the mucosa.

In some case the thickening, containing muscular tissue and epithelial structures, has been wrongly designated *salpingitis nodosa isthmica*. Lipoma is almost unknown. A case has been described by Rokitansky.

Embryomata of the tube-wall are extremely rare.

Orthmann has reported one in a woman of thirty-three. The right tube was enlarged and contained fat, hair, and a tooth-like body of cartilaginous consistence. All three layers of the blastoderm were represented. Orthmann believed the mass to have developed from a pole-cell or a blastomere.

Polyps of the tube may be formed by carcinomatous, sarcomatous, or papillomatous growths; by inflammatory changes; as a result of decidual changes; from hemorrhage into a limited portion of the mucosa.

CHAPTER XIV.

MALFORMATIONS OF THE UTERUS.

The normal development of the uterus has already been considered (p. 33).

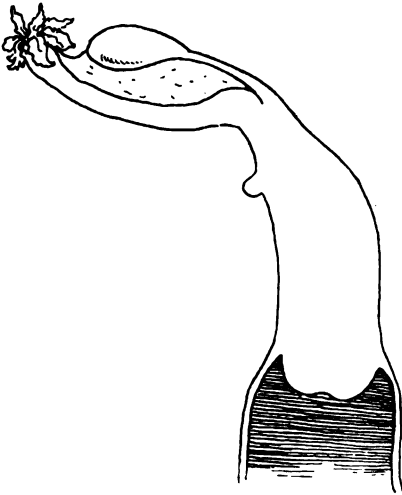


Fig. 241.—Uterus unicornis.

Malformations may be regarded as failures or arrests in development, and the great majority of these are associated with the embryonic and fetal periods of antenatal life. In the first month of intra-uterine life the uterus is represented by the two solid Müllerian cords; in the second and third months these are hollow and blend in their lower parts to form a uterovaginal canal. In the succeeding months the body of the uterus is gradually formed, the fundus being at first concave, then flat (*uterus planifundalis*), then convex (*uterus foras arcuatus*; *uterus foetalis*). After birth, for about ten years, the infantile uterus is characterized by greater development of the cervix than of the body. Thereafter, increase in the size of the body takes place until the adult shape is reached.

As to the causes of malformation, little is known. Balantyne suggests the influence of toxins, poisons, and germs.

In the condition of trifid uterus or *uterus accessorius* it is probable that two Müllerian ducts have existed on one side in early embryonic life.

Complete Absence of the Uterus.—This is a very rare condition. The bladder and rectum touch. The tubes are absent, rudimentary, or represented by solid rods; the ovaries are absent, rudimentary, or of normal size. The vagina is absent or partially developed. Complete absence of uterus, tubes, and ovaries has been described only in monstrosities. Sometimes signs of hermaphroditism exist.

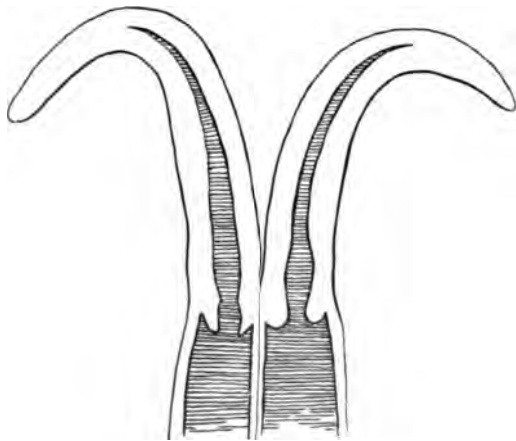


Fig. 242. Uterus didelphys.

Rudimentary Uterus.—This is found in various conditions. It may be a mere thickening on the posterior bladder-wall, or a band continuous with the Fallopian tubes and round ligaments. Sometimes there is a distinct median

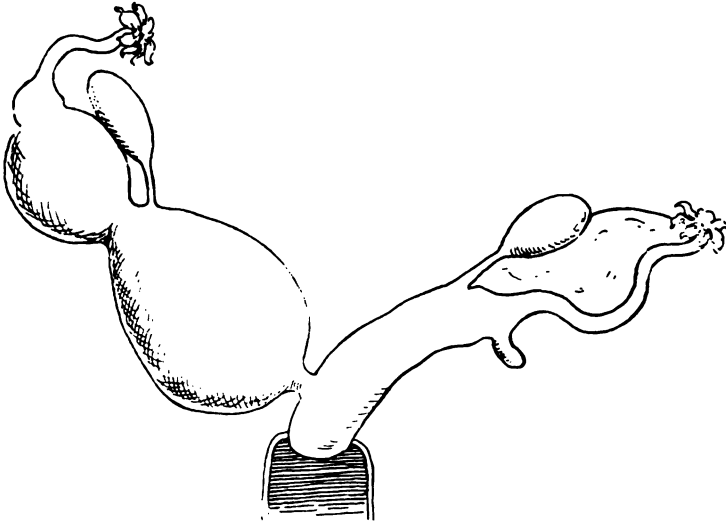


Fig. 243.—Bicornute uterus with fibrous attachment between right and left horns. The right horn and its tube are somewhat distended with blood.

lump ending in the vagina; in some cases this may resemble a cervix. A rudimentary cavity may be present.

The uterus may sometimes be represented by two vertical ridges. The vagina may be absent or small; the outer genitals may be normal, small, or maldeveloped.

In the form termed *uterus bipartitus* there is a poorly developed cervix continuous with two rudimentary cornua, usually solid, sometimes possessing a lumen. The ovaries may be normal, absent, or maldeveloped. The vagina is often malformed.

Uterus Unicornis.—In this form only one cornu is developed; it is directed from the cervix upward and toward one side. The other cornu is absent or rudimentary, and the corresponding Fallopian tube is usually absent. The rudimentary horn may be a mere solid band; it may be hollow for a short distance or in its whole length. Pregnancy may take place in this rudimentary horn or menstrual blood may accumulate in it (see pp. 438, 439). The

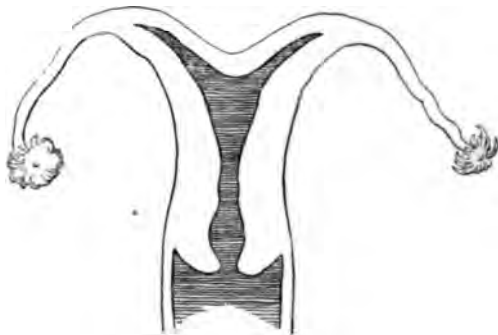


Fig. 244.—Uterus bicornis. The upper part of the body only is divided.

ovary and tube on the imperfectly developed side may be rudimentary or absent; sometimes they may lie in the lumbar region. The corresponding kidney and ureter may be wanting, and the bladder maldeveloped. The vagina is narrow, absent, or septate.

To distinguish between tube and horn the insertion of the round ligaments should be noted.

Uterus Didelphys.—This condition is rare. In it the two original Müllerian

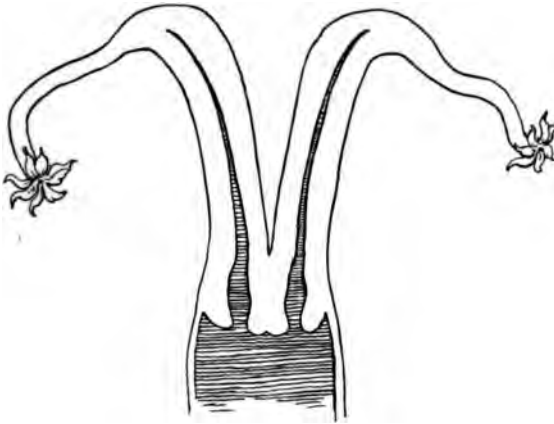


Fig. 245.—Uterus bicornis bicollis.

portions of the uterus do not blend. Sometimes the uterus on one side is poorly developed. There are two vaginas joined by connective tissue.

One vaginal canal may sometimes end above the vulva, so that menstrual blood cannot escape from the corresponding uterus. There may thus be a unilateral blood-accumulation.

Uterus Bicornis.—In this condition the uterus is more or less divided into

two parts by means of an external depression. The separation rarely extends through the cervix, though sometimes the latter may be divided by an internal vertical septum. The malformation may be considered as intermediate between the *uterus didelphys* and the *uterus septus*. There is found quite a range of variation in shape, from a mere depression at the fundus (*uterus arcuatus*) to a division extending into the cervix. Ordinarily there is a single os externum (*uterus bicornis unicollis*); sometimes it is double (*uterus bicornis duplex vel bicollis*). When the body is not completely divided, there is usually an internal septum below the division. One or both horns may be imperforate in one or both parts, and consequently menstrual blood may accumulate. When both are open, menstruation may occur simultaneously in both or alternately from each. The vagina may also be septate in various degrees.

Uterus Septus vel Bilocularis.—Here the uterus has the normal external appearance, but inwardly a median septum, which may reach from the fundus to the os externum, or not so far down. The term *uterus subseptus vel semipartitus* is applied to the case in which there is an incomplete septum in the body or cervix.

Sometimes there may be a slight grooving externally corresponding to the internal septum. The vagina may be normal or completely or partially septate.

Uterus Infantilis vel Fetalis.—In this condition the uterus has the fetal

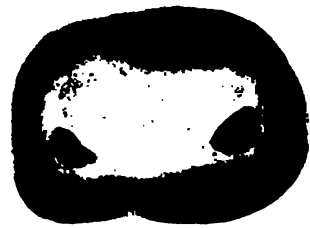


Fig. 246.—Cervix with duplicate os.

characteristic, namely, shortness of the body relative to that of the cervix; the latter may be two or three times the size of the former. The uterine cavity may be small or absent. Variations between this condition and the adult uterus may also be found as a malformation in the adult.

There is frequently poor development of the tubes, ovaries, vagina, and mammæ. Thus partial development of the body may be found, such as normally takes place prior to puberty—*uterus pubescens*. Here the body may equal the cervix in length or may be slightly longer.

Atrophied Uterus.—

This is a condition of uterus sometimes found in the adult, in which the organ has the adult shape, but is undersized. Sometimes the cervix only may be poorly developed.

The causes of this condition are not very evident. There is in some cases a fault of development. Local chronic parametritis atrophicans (Freund) may sometimes be a factor. In dwarfs and cretins the imperfect development is often found. In early tuberculosis also, in chlorosis and poor health from other important causes, certain diseases of the nervous system, e. g., hysteria, epilepsy, the condition may exist.

Atrophy is to be regarded as a normal condition in lactation. Vineberg has recently drawn attention to this change, which is fully developed two or three months after labor. Differences are found in the degree of superinvolution, measurements of the cavity varying from 4.5 to 8 cm. The whole uterus is diminished, the atrophy being least marked in

cases in which menstruation occurs during lactation. Usually the uterus returns to its normal size two or three months after nursing. Menstruation may return while atrophy exists.

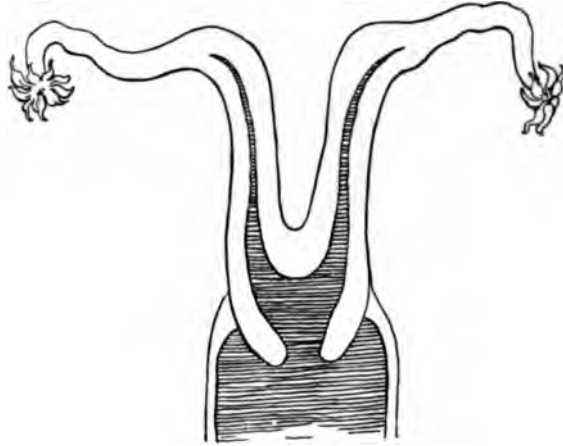


Fig. 217.—Uterus bicornis unicollis.

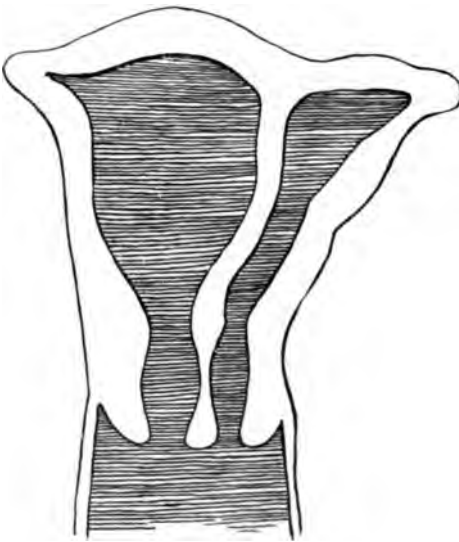


Fig. 248.—Septate uterus in which one-half is more developed than the other.

Very rarely does permanent atrophy continue after prolonged nursing. Vineberg states that the degree of atrophy bears no relation to the percentage of red blood-corpuscles or hemoglobin. This lactation atrophy is probably due to the reflex action on the uterus of the irritation of nursing, but Hansen and P. Müller state that where there is no lactation, the uterus atrophies, so that between the sixth and tenth weeks after labor it is smaller than at a later period.

Diagnosis.—When the uterus is absent, there is, of course, no menstruation. The female may undergo all the other changes which take place at puberty, *e. g.*, hair and breasts may develop when the ovaries are functional. In a rudimentary condition of uterus there is no menstruation. Menstrual molimina occur when the ovaries are functional, and in some cases excessive pain may be caused. Vicarious menstruation has sometimes been reported.

On examining the pelvis in these cases it is well to pass a sound into the bladder; the rectal finger feels it readily when the uterus is absent or rudi-

mentary. It is important to make an abdominorectal examination under anesthesia. When the unicornute uterus exists, the well-developed horn may perform all the functions of the normal uterus. If the rudimentary horn be pervious for a distance, accumulation of menstrual blood may take place in it, though, sometimes, this does not occur. It has occasionally happened that no menstruation takes place from the developed horn, blood accumulation occurring in the other (P. Müller).

The distended horn is felt as an elastic or firm mass, often sensitive to examination. It may be very adherent to surrounding structures. It is important to remember that a pregnancy may also take place in it, leading to a very serious condition.

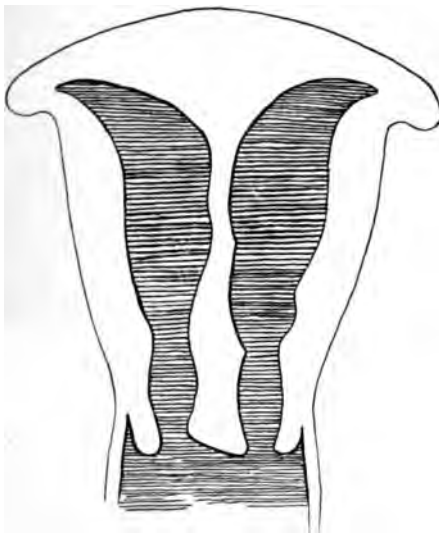


Fig. 249.—Septate uterus.

In the case of uterus didelphys, there are no symptoms unless the vagina be absent or atresic or one horn be closed. On physical examination two separate cervixes or separate cervical openings are felt. A sound may be passed into each horn and the condition determined by abdominorectal exploration. Menstruation may take place from both simultaneously or alternately. Pregnancy may occur in one or both uteri; if in one, decidual transformation occurs in the mucosa of the other side. Discharges of blood may also take place from the nonpregnant half. There may be obstruction in labor from the empty portion.

In uterus bicornis there are no distinguishing symptoms; menstruation is often normal, but may be irregular. It may take place in both horns simultaneously or alternately at monthly or bimonthly intervals. When one horn becomes pregnant, the other usually stops menstruating, though in

some cases it may continue. Pregnancy may occur in both horns at the same time. Atresia of one horn may be found, leading to an accumulation of blood above it; the sac gradually pushes the open horn toward the opposite side of the pelvis, and forces the cervix and vaginal vault downward and toward the opposite side. Bimanually the mass is felt as a firm elastic swelling. The unclosed os is crescentic, and is stretched over the lower end of the mass, when the atresia is cervical.

P. Müller points out that there is no record of a pregnancy in the closed horn in such a case, though it may occur in the rudimentary horn associated with a unicornute uterus.

The septate uterus is usually recognized only when a septum is felt in the cervix. When the septum does not extend down so far, the condition may never be found out.

Sometimes a vaginal septum of greater or less extent may exist with the bicornute uterus, and may cause a suspicion of the latter condition.

When a complete septum exists, sounds passed into both halves do not touch. On bimanual examination the distinction between the horns may be made out.

In the infantile and atrophied uterus there is generally no menstruation, and there may never be any pelvic disturbances. Often, however, there are periodic pains in the pelvis, with a flow of mucus from the genitals, and there may be scanty and irregular discharges of blood. Periodic disturbances of other organs have been noted in some cases, *e. g.*, stomach disorder, palpitation, pains in breasts, head, etc. Vicarious bleedings have been occasionally described. Neuroses are apt to develop in these cases. Sterility generally marks the condition, but pregnancy may occur.

Bimanually, the small uterus may be made out, especially if the sound be passed into its lumen at the same time.

When in any of these conditions menstrual blood accumulates above an atresic area, pain is present during the periods, and in many cases afterward, increasing in duration until it may become more or less continuous. The mass may cause pressure disturbances. Peritonitis often takes place outside it, and its contents may become infected. It may rupture into abdomen, vagina, the neighboring horn, the bladder, or the bowel.

Differential Diagnosis.—The unicornute uterus must be distinguished from the infantile, atrophied, and rudimentary uterus. The rudimentary cornu may be mistaken for a small fibroid; when distended, it may be mistaken for a tubal, ovarian, or broad-ligament swelling. A bicornute uterus, with one horn closed and distended, may be diagnosed as a normal uterus associated with a fibroid, ectopic pregnancy, or some other pelvic swelling. This may be the case with a septate uterus or with the uterus didelphys.

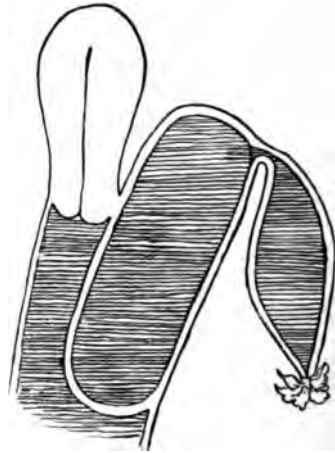


Fig. 250.—Uterus bicornis bicollis, in which there is atresia of the left cervix. Above the latter is an accumulation of blood which forms a swelling bulging into the vagina.

Treatment.—In the unicornute uterus with a rudimentary horn treatment is necessary when accumulation of blood occurs in the latter.

Abdominal section should be performed and the mass removed. At the same time the opposite horn should be examined. If it is not well developed, the Fallopian tube attached to it should be excised in order that pregnancy may never take place. If the mass cannot be taken away, it should be emptied and stitched into the edges of the abdominal incision, both ovaries being removed. If pregnancy takes place in this horn, removal is also necessary. In the bicornute uterus, when distention of one half occurs above an atresic portion, the collection may be opened per vaginam. If, however, the Fallopian tube on the same side is much distended, it is best to perform an abdominal section first of all, and either to remove both distended tube and cornu, or to remove the tubal portion, and, at a later date, to open the cornu through the vagina.

In a septate uterus, where distention of an atresic half has occurred, an opening must be made by way of the cervix. If the corresponding tube is much distended, a preliminary abdominal section for its removal must be carried out.

In cases of deficient development of the uterus the organ cannot be enlarged by treatment.

Atresia of the Cervix.—

This may be due to acquired causes (*vide* p. 464), or may be congenital. It may be found in the single uterus, when the whole cervix may be atresic, or may occur in one half when the organ is septate. Mucus may collect in the uterus before puberty, but generally the condition is made out only after

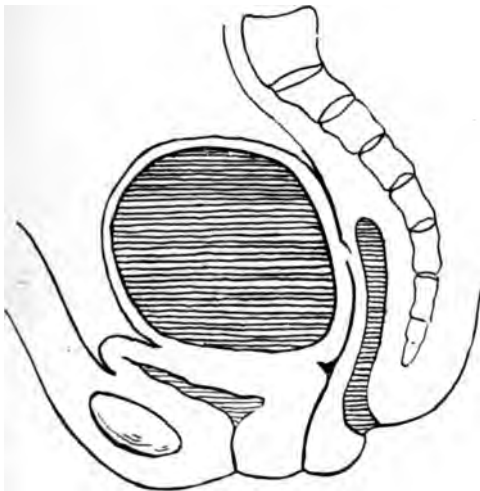


Fig. 251.—Atresia of cervix. The uterus is distended with blood.

menstruation begins, owing to the accumulation of menstrual blood. (For the results of accumulation, see "Atresia of the Vagina.")

Atresia may also affect one or both horns of a bicornute uterus or a unicornute uterus. I have already referred to its occurrence with a rudimentary horn.

Treatment.—*Vide* "Atresia of the Vagina."

Abnormal Communications of the Uterus.—There may sometimes be found an opening into the rectum or bladder or into both. Impregnation has taken place either by way of the rectum or urethra. These conditions are remains of the cloacal state.

Doran has reported a bipartite uterus opening on one side to the outer surface of the body. The uterus may also sometimes communicate with the ascending colon.

MINOR MALFORMATIONS.

The uterus may sometimes be obliquely shaped, owing to the imperfect development of the organ. The condition might be mistaken for a unicornute uterus.

Sometimes the uterine fundus is straight, giving the name of anvil-shaped (*uterus planifundalis*, *incudiformis*, *biangularis*) to the organ.

Sometimes the vaginal portion of the cervix may be small or rudimentary (*uterus parvicollis* or *acollis*). It may be elongated or conic.

Uterus biformis is the condition in which a median partition divides the os externum into two parts. A trifid uterus, *uterus accessorius*, is very rare.

Abnormal Folding of the Cervix.—Sometimes a flap-like circular projection may be found inside the cervix (like that normally found in the sheep), forming a second os externum. It may be mistaken for a polyp, and may give rise to hemorrhage. It may obstruct labor, and should be removed when recognized.

Premature Development of the Uterus.—The uterus may develop in early life into the adult form, with or without accompanying changes in the rest of the genital tract, and with one or more of the general changes met at puberty associated with the development of secondary sexual characters.

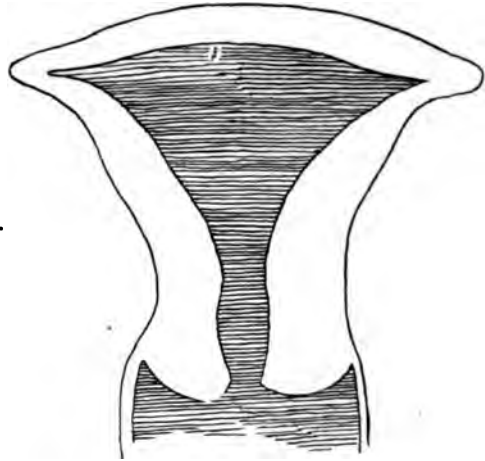


Fig. 252.—Uterus incudiformis. The uterus is anvil-shaped.

CHAPTER XV.

INFLAMMATION OF THE UTERUS.

Inflammatory processes in the uterus vary greatly as regards the site and extent of tissue involved, the intensity and duration of the affection, and the character of the alterations produced.

It is usual to consider the subject according to the predominant tissue affected. Thus the endometrium is described apart from the myometrium, and the former is divided into the corporeal and cervical mucosa. While these various structures normally differ histologically as well as when they are altered by inflammation, it is rare to find one particular tissue exclusively affected; usually more than one tissue is involved. Thus, while endocervicitis is studied by itself, it must not be forgotten that there may be an accompanying inflammation in the endometrium above the cervix, or in the muscular part of the wall. Also, in considering chronic metritis, while attention may be mainly fixed on the changes in the muscular thickness of the wall, it is to be noted that the mucosa or the peritoneal covering or both may also be inflamed.

Etiology.—It is now thoroughly established that inflammatory changes in the uterus are chiefly due to the influence of micro-organisms or their products.

Infection may reach the uterus in various ways:

1. Through the blood. In general infective diseases, *e. g.*, the acute exanthemata, metritis may result from the action of circulating micro-organisms or toxins.

2. By extension from neighboring diseased parts. Thus a septic process spreading from a diseased appendix or any other infected focus may spread to the organ.

3. By infection introduced through the lower genital canal. (*a*) In connection with abortion or labor. (*b*) Resulting from faulty technic in operative procedures. (*c*) Gonorrhea. Other factors are usually described, *e. g.*, chills, uterine displacement, uterine tumors, the congestion of menstruation, but the exact relationship of these elements to inflammatory processes cannot be definitely stated.

In all probability such mechanic or chemic influences most commonly act by rendering the tissues more liable to the attack of micro-organisms. The mechanic disturbances, for example, resulting from labor, such as stretching, bruising, and tearing of the genital tract, establish the most favorable conditions for activity of invading organisms.

Careful bacteriologic investigations in different varieties of metritis have led to the discovery of organisms whose infective characters are well established. This is particularly true of acute affections, *e. g.*, puerperal sepsis. In many chronic processes organisms have also been found, *e. g.*, gonococcus, but in many other cases in which chronic changes exist no organisms can be found, probably because the germs had previously disappeared or cannot be recognized

or cultivated by the staining or culture methods employed. There is ground for believing that a large percentage of infections are due to the action of mixed organisms, and not to the exclusive influence of one variety, though the latter may be the predominant factor.

Taussig states that the gonococcus is the cause of about one-sixth of all cases of puerperal infection, being usually secondary to a gonorrheal process elsewhere.

VARIETIES STUDIED IN DETAIL.

ACUTE METRITIS.

1. In Connection with Abortion and Labor.

Pathologic Anatomy.—The cervix may be variously affected. Sometimes it is only congested and edematous. Frequently, torn or bruised areas are the seat of microbial growth, appearing as dirty, yellow-gray patches bathed in pus.

In some cases these patches resemble those produced by diphtheria. In rare instances the Klebs-Löffler bacillus may be the cause of these patches; ordinarily it is due to streptococci. It may also be caused by staphylococci, colon bacilli, and by anaërobic putrefactive organisms. The edge of the patch is usually edematous, and the swelling may extend from it to a greater or less extent. It is rare that these localized infections are fatal. When marked disturbances are present, it is almost certain that the infection has spread to other parts or has become general.

Occasionally the changes may be of rapid, malignant type, the superficial tissues having a gangrenous appearance. In some cases recovery is accompanied with extensive sloughing.

Uterine Body.—Various changes may be found in the uterus as the result of infection, being most marked and most frequent in the remains of the mucosa. Both placental and nonplacental areas may be affected. The following naked-eye appearances may be found:

In some cases the surface is bathed in pus. In others it is covered with a dirty, yellow-gray membrane, composed mainly of necrosed decidual tissue and fibrin, diffused over a wide area or localized in one or more patches. Sometimes thick, shaggy masses may be found, especially on the placental area; these may contain fetal remains or may consist entirely of fibrin and shreds of decidua. In some cases the lining of the uterus may have a dark-



Fig. 253.—Septic infection following abortion. Many chains of streptococci are seen in the remains of the uterine mucosa.

green, gangrenous appearance. When saprophytic organisms are present, there is usually an odor, and bubbles of gas are often present in the discharges. It is important to remember that these organisms are frequently present when true pyogenic germs are active. When infection is alone due to the latter, odor and gas are usually absent. The uterine wall is enlarged, relaxed, and softer than normal, in some cases being very friable. This relaxation of the wall undoubtedly promotes the extension of infection, the diminution of pressure on the vein and lymph-channels making it easier for micro-organisms to pass along them.

Frequently on section small collections of pus may be seen, usually in lymphatics or in veins. In the latter thrombi sometimes may be found in various stages of suppuration. True abscess formation outside of the veins and lymphatics is very rare. Rarely, extensive gangrene or necrosis of a large area of the uterine wall occurs, followed by expulsion through the vagina. By some this condition has been termed *metritis dessicans*. On the outer surface of the uterus various stages of inflammation may be found; it may sometimes be covered with a layer of fibrin, especially posteriorly. Under the peritoneum small, cord-like elevations are sometimes present; these are lymphatics containing pus or thickened by inflammation. The whole uterus is usually larger than normal, being soft and flabby and easily indented by slight pressure. The cervical canal is generally patulous.

On microscopic examination various appearances are presented. In cases of infection by streptococci or other pathogenic organisms the superficial portion of the endometrium is more or less hyaline in appearance and stains badly, being altered by coagulation-necrosis. This change is found as a thin, irregular layer, being less marked than in cases where putrefactive organisms are at work. Underneath there is a leukocytic infiltration, varying in thickness and forming a continuous or irregularly broken layer. On the surface of the endometrium are scattered the infecting micro-organisms; they are also found in the superficial necrotic tissue.

In some cases, especially those in which the organisms are not virulent, they are not found deeper than the leukocytic layer; in others they extend through the latter at various points, spreading especially through lymphatics outward into the musculature. In the placental area the organisms may be found in the thrombi filling the divided sinuses, extending also inward along the vessels, producing inflammatory changes in their walls. In certain bad cases local areas of liquefaction may be noticed, surrounded by leukocytes and early abscess formation.

These generally begin in lymphatics, and are especially found under the peritoneum. It is impossible to describe accurately the changes that occur in the muscle-fibers themselves. They often stain badly and present marked granular and fatty changes, but the latter are found in the normal postpartum uterus. In cases which recover there may be considerable atrophy of muscle and increase of the intermuscular connective-tissue elements.

In putrid or saprophytic endometritis the superficial necrotic layer is generally thick. If fetal remains are present, they also may show necrotic changes. The micro-organisms are on the surface as well as in the substance of the degenerated layer; they are not usually found below the latter, being unable to penetrate the protective zone of leukocytes.

In cases of mixed infection by putrefactive and septic organisms the former are found mainly in the necrotic layer, while the latter may be found under it, extending toward the peritoneum. Or if two septic organisms are present, one may remain superficial, while the more virulent may penetrate deeply. In some instances both may be equally distributed.

Signs and Symptoms.—It is evident, from the variety of organisms which infect the puerperal woman, and from the great range of changes occurring in the body, that many variations must be found in the clinical manifestations produced. It is best to study these in relation to the pathologic conditions. In the common form of septic infection commencing in the endometrium, symptoms usually begin on the third or fourth day, though sometimes not until two or three days later. In gonorrhea the infection usually manifests itself six or more days after labor. During the period immediately following labor the organisms multiply in the superficial layer of the endometrium, while deeper down there is an outpouring of leukocytes, forming a barrier or zone of resistance. In this interval the patient usually feels well. The first indication of illness may be a feeling of malaise, headache, or chilliness; there may be a marked rigor, followed by a rise in temperature and in the pulse-rate. In some cases more than one severe chill may occur. The temperature and pulse may remain elevated after the first alteration, varying from time to time, or they may become reduced soon after the early rise. The greatest differences are found in the temperature, and these are probably mainly due to the character and quantity of the toxins absorbed from the uterus. In some instances hyperpyrexia may occur, the temperature reaching 107° – 112° F. In most cases such a rise indicates that death is near, but sometimes the patient may recover satisfactorily. It is frequently as high as 103° F., and may reach a higher point. The pulse often follows more or less closely the temperature-curve, but sometimes this relationship may not be present. In some cases the pulse-rate may be the chief indication of serious danger; indeed, it may be the first important sign. The tongue usually becomes coated and the desire for food lessens; constipation is frequent, though sometimes there is diarrhea. Often, as elevation of temperature continues, the milk secretion is diminished.

The lochial discharge is frequently increased and may change in appearance, owing to the addition of yellow or white purulent material. It has no odor or only a faint one. A fetid smell indicates that saprophytes are at work, but one must never conclude from this sign that septic infection is not present; both forms may be combined. The blood in the lochial discharge may be considerably altered, becoming dark brown or chocolate-colored. In some cases there may be a marked diminution in the quantity of lochia. This is usually the case when the temperature continues much elevated, though it may sometimes merely indicate an accumulation in the uterine cavity, which often becomes enlarged. Organisms may be found in the discharge.

The uterine wall normally relaxes somewhat, its volume being increased and its consistence less firm; it may be somewhat sensitive on palpation. If an intra-uterine examination be made, the cervical canal is found to be patulous or easily dilated. The inner wall feels much the same as in noninfected cases—*i. e.*, the nonplacental area is fairly smooth and the placental area is slightly irregular. When remains of placenta or membranes are attached to the wall, these may be felt as shaggy, irregular masses.

If putrid endometritis be present in a marked degree, superficial projecting portions of necrotic tissue may be felt. The symptoms associated with the latter condition vary considerably, and in the early stages may resemble those of septic endometritis. As the case proceeds, the general systemic disturbances are rarely as severe as in the latter condition. When the colon bacillus or *Bacillus aerogenes capsulatus* causes the putrid endometritis, there may also be a systemic invasion by the micro-organisms. The ordinary saprophytes are, however, usually limited in action to the inner wall of the uterus, the systemic disturbances being due to the toxins produced by their action and absorbed into the system.

The progress of puerperal endometritis varies greatly. Subsidence may be rapid, or gradual and prolonged, and exacerbations may occur. In cases which run a lengthy course the patient becomes much reduced in strength, the various functions of the body being imperfectly performed as a result of the continued poisoning. Fatal cases are usually those in which the micro-organisms have invaded the body outside of the uterus.

Prognosis.—Under modern methods of treatment it is certain that puerperal infection, speaking generally, is less fatal than in the preantiseptic days. Severe types of the affection are much less frequent. The earlier the signs and symptoms of infection appear after labor, the more serious the case. The most fatal are those in which the phenomena develop within thirty-six or forty-eight hours. The outlook is very grave when the peritoneum is infected or when there is general septicemia; the pyemic form is also very serious. When the micro-organisms are limited in their activity to the uterus or neighboring parts, the outlook is hopeful. In the mildest cases it must always be remembered that death may sometimes follow suddenly from embolism, though this is rare. More frequently a mild type may change to a severe type, owing to renewed activity of the micro-organisms already present or to infection with others. It is important also to note that after-results—*e. g.*, chronic ovaritis, salpingitis, etc.—in cases which do not end fatally are often more marked after mild infection than after those which are severe. The streptococcus is the most common cause of serious infections, though it varies greatly in its manifestations. The colon bacillus is frequently fatal in its action. The gonococcus and staphylococcus, in the great majority of cases, produce local changes which rarely cause death, but often lead to troublesome chronic disturbances. The anaërobes or saprophytes are usually the least dangerous infecting agents, the results of their activity being generally local. Occasionally, however, a serious general infection may be caused, *e. g.*, by *Bacillus aerogenes capsulatus*.

When infection is due to more than one organism, the prognosis must be more unfavorable. When the patient has been in poor health, has passed through a tedious, difficult, or complicated labor, or has lost much blood, the outlook is more serious. Continued high temperature or pulse indicates a serious condition, especially if they persist after therapeutic measures have been carried out to clean up local infected areas in the genital tract. Marked alterations in the kidneys are very unfavorable.

Diagnosis.—In the great majority of cases it is easy to diagnose puerperal infection. Occasionally, however, there is difficulty, especially in the early stages, when there is no localization of symptoms or signs.

The greatest caution must be exercised in depending upon the temperature and pulse. After labor these may sometimes be elevated by causes other than infection. Thus, if delivery has been very tedious and exhausting, the temperature may rise a degree or more. In the succeeding days emotional excitement of any kind may cause it to rise several degrees, though it usually falls rapidly again. Sometimes in nervous women there may be a simulation of rigor. Undue distention of the breasts, producing distress, may cause slight elevation of temperature; if any of the milk-ducts be obstructed, there may be a marked rise, especially in nervous women. In such cases, however, it is not always easy to eliminate the possibility of infection in the breasts until some hours have elapsed. Normally there is very little rise in temperature—less than half a degree or none at all—in connection with the establishment of the milk secretion. The pulse usually corresponds to the temperature in these various conditions. When much blood has been lost, the pulse remains rapid after labor and the temperature is more easily elevated.

In some cases it appears that autointoxication from the bowel may cause an elevation of pulse and temperature, simulating infection. It may or may not have been preceded by marked alimentary disturbances in pregnancy. The symptoms are probably generally due to the absorption of toxins produced by the intestinal micro-organisms. Dumont and others believe that in some cases colon bacilli actually pass into the peritoneal cavity; Budin was the first to insist on this in 1892, and others have made similar statements. In this condition there are usually loss of appetite, malaise, headache, flatulence, distress, and pains in the abdomen. The pulse and temperature may be elevated and there may be rigors. The tongue is foul, the breath bad, and the intestines usually distended with gas. Distress may be caused by palpating the abdomen. The administration of purgatives and enemas produces large evacuations, and rapid improvement in symptoms usually follows, though in some cases recovery may be slow.

The temperature may rise before an evacuation can be obtained, probably because the liquefaction of the feces caused by the medicines allows more toxic matter to be absorbed.

Septic inflammation in the breast may simulate infection through the genital tract, and until definite mammary signs have developed, there may be great uncertainty as to the exact condition. It must always be remembered that occasionally both pelvic and mammary infection may be present. Sometimes an intra-abdominal infection may follow injury to old infected areas—*e. g.*, ovaritis, salpingitis—produced during labor. In such a case the previous history might lead to a suspicion of the condition, while cultures from the interior of the uterus should be sterile. Torsion of the pedicle of tumors may also result in changes that may simulate puerperal infection. A knowledge of the previous history and careful examination are necessary to make a diagnosis. Malaria may sometimes affect women after labor and may be mistaken for puerperal infection. More frequently, however, the latter is diagnosed as the former, often purposely. The diagnosis of malaria should not be made unless the plasmodia of this disease are found in the blood and the uterine discharge is found to be free from infective organisms. Typhoid fever is also frequently diagnosed in cases of infection, but the diagnosis should be made only if the Widal reaction is decided. This disease may undoubtedly some-

times manifest itself in the lying-in woman, though rarely. An exacerbation of an old tuberculous lesion may sometimes follow labor, and may easily be mistaken for puerperal sepsis. Influenza, especially the atypical forms, may simulate an infection. It is believed that the secondary streptococcic or staphylococcic infections that may follow this disease may sometimes actually cause puerperal sepsis. In all doubtful cases bacteriologic examination of the uterine cavity should be carried out where the circumstances are favorable to this procedure. Döderlein's lochial tube should be used in collecting the fluid to be tested. It is about 25 cm. in length, 4 mm. in thickness, and is bent slightly at one end. As Williams suggests, this is most conveniently sterilized and carried in a large test-tube resting in cotton-wool. The patient should be placed in the Sims or lithotomy position and the external genitals thoroughly cleansed. The hands of the operator and his assistants should also be disinfected. With a vaginal speculum, aided by retractors if necessary, the vagina should be opened, the cervix drawn down with a volsella, and wiped clean with sterile wool. The lochial tube is then removed from the test-tube and its curved end passed high into the uterus. To its outer end a piece of sterile rubber tubing is attached and to this a syringe is joined, for the purpose of drawing some of the uterine contents into the tube. The latter is then withdrawn, its ends being closed with sealing-wax, and it is carried in its case to the laboratory, where it is broken in order that cultures may be taken from the contents and cover-glass preparations stained.

Treatment.—*Prophylactic.*—Bearing in mind that in the great majority of cases infection is due to carelessness in the technic observed during delivery, the physician should insist on the observance of the same rigid measures by those who assist him as well as by himself which would be enjoined by a careful surgeon in the conduct of a surgical case.

Curative.—When the perineum or lower part of the vagina is infected, it is necessary to destroy the organisms as soon as possible, in the hope that they may be prevented from spreading upward into the uterus. For this purpose the author has employed the following plan: The patient is placed in the lithotomy position and the vagina exposed, the affected area being washed with 50 per cent. peroxid of hydrogen solution. A gauze tampon is then placed in the vagina, soaked in a solution of formalin in glycerin and water (formalin, 30 min.; glycerin, 4 dr.; sterile water, 1 pint). After twelve hours the gauze is withdrawn, the affected parts again washed with peroxid, and fresh formalin gauze reintroduced for twelve hours. This may again be repeated until the infected area is in a healthy healing condition. This method is preferable to the employment of antiseptic douches, because it allows of the continuous application of a powerful penetrating antiseptic.

When the uterine cavity is infected, it is important to determine the condition of the uterus and of the entire contents of the pelvis. Some discharge should be first collected in a glass tube, from the interior of the uterus, in the manner already described. A thorough bimanual examination should be made to determine the condition of the ovaries, tubes, peritoneum, and parametrium. One or two fingers should then be introduced into the uterus to palpate its inner wall and to determine whether there is much débris in the cavity. If the wall has no abnormal masses attached to it, the débris in the cavity should be simply washed out with normal salt solution. Curetage is

not indicated in such a condition; it is, indeed, an unwise procedure. The infecting organisms in such a case are mainly in the superficial layer of the endometrium, while leukocytes are accumulated in a deeper zone as a line of first defense. In the great majority of cases this protecting zone is not penetrated, or is to such a small extent that serious systemic invasion does not occur. Curetage is dangerous, because it breaks into this protecting zone, exposing fresh raw tissue, which is likely to be invaded by the micro-organisms, which cannot, of course, be entirely removed by the curet.

The inner wall of the uterus should, indeed, be disturbed as little as possible. The author strongly advises introducing into the uterine cavity gauze soaked in an antiseptic solution that is penetrating and not dangerous to the system in the strength in which it is employed. For several years he has employed the glycerinated formalin solution referred to above. The gauze is left in the uterus about twelve hours, a fresh piece being then introduced. This procedure may be repeated one or more times if the patient's condition does not rapidly improve. In cases in which the organisms have not passed beyond the uterus it is rarely necessary to use more than one or two applications of the gauze. When there is evidence of general systemic invasion or of pelvic infection external to the uterus,—*i. e.*, parametritis, salpingitis, etc.,—it is useless to continue the intra-uterine applications.

The author has entirely abandoned the use of intra-uterine antiseptic douches in these cases, because it has been abundantly proved that the temporary dribble of such a stream is utterly without destructive or inhibitory effect on the micro-organisms, so many of which are not on the surface, but in the tissues. Moreover, it has been clearly shown that the employment of salts of mercury, so frequently employed in intra-uterine douches, is not without risk, several deaths having, indeed, been reported in recent years. There is, indeed, no place for the use of these salts or of others that are likely to damage the tissues or poison the system.

Schucking's method of irrigating the uterine cavity continuously with an antiseptic lotion is rational if a solution be used that will not injure the tissues or poison the system. Though it has been enthusiastically adopted in some quarters, it has not been favorably received by the profession, on account of the inconvenience associated with its employment. The author's plan of using a tampon soaked in an antiseptic is a simpler method, and is suitable to private as well as to hospital practice. The plan of swabbing out the uterus with strong solutions—*i. e.*, corrosive sublimate, phenol, formalin, etc.—is to be condemned, because of the destruction of tissue that is produced. No such risks exist with the use of gauze soaked in the solution of formalin that I have employed. When the wall is abnormally rough and shaggy and the lochial discharge has an odor, it should be scraped with the fingers and the débris should be washed out of the uterus with a stream of normal saline solution or swabbed out with pieces of gauze held in forceps. If the projecting masses are not completely removed in this way, a curet-forceps should be employed. Occasionally it may be necessary as well to use a curet. Afterward gauze soaked in the glycerinated formalin solution should be introduced into the cavity for twelve hours and then changed.

In all cases of infection of the uterus ergot should be administered to counteract the tendency to relaxation in the uterus, in order that the lymphat-

ics and veins may be compressed and so rendered less liable to convey infection. When there is evidence of localized pelvic inflammation beyond the uterus, an ice-water coil may be placed on the lower abdominal region, the water being allowed to circulate continuously through it. Many prefer to use hot fomentations rather than cold, patients usually preferring the former. When there is evidence of general intoxication from toxins, or of an active general septic process, it is important to keep up the patient's strength by easily digested nourishing food—*i. e.*, milk, plain or peptonized, plasmon, somatose, beef-juice, etc. Of great value are high rectal injections of warm normal saline solution (a pint every five or six hours). This fluid has some nutrient value, is a stimulant, promotes the activity of the kidneys and skin, and dilutes toxins circulating in the system. If sodium acetate be added to it, the diuretic action is increased. The bowels should be kept regularly open. Brandy or whisky is valuable where there is much exhaustion and where abundant nourishment must be supplied continuously to make up for excessive waste of tissue. As much as 10 or 12 ounces or even more may be administered in twenty-four hours, chiefly for the food-value, though the stimulant action is also important. One of the best stimulants for impaired cardiac action is strychnin given in large doses. The antipyretics that are so widely employed are inadvisable, as they are apt to depress the patient. Hydrobromate of quinin may, however, be given (3 to 5 gr. three or four times a day) without causing depression or any disturbances. When the fever is high, the cold pack, cold sponging, or cold baths are valuable, causing the same benefits as in the treatment of typhoid fever. The baths should not be used if there be peritonitis, a pelvic exudate, or phlegmasia alba dolens. Mace, an enthusiastic advocate of the bath, recommends that the water should be about 75° F., the same precautions being observed as in the treatment of typhoid.

In 1886 Schultze, of Jena, performed hysterectomy in a case of retained placenta with infection, and since that time the operation has been carried out in puerperal infection by others. At present it is little practised, because it is difficult to establish definite indications for its performance. Extensive infection of the uterine wall, with abscess formation, is considered by some a suitable indication, and, indeed, it may be so regarded, but, unfortunately, when this condition exists, the whole system is likely to be invaded by infecting organisms, which will continue to be active after the uterus is removed. If, however, there is considerable certainty that they are mainly localized in the uterus, vaginal hysterectomy may be advisable. The general condition of the patient should be such as to warrant its performance. Bonamy has collected 31 operations, in which 11 deaths occurred; Treub, 36 cases, in which 21 deaths resulted. The latter author states that he has treated 734 cases of puerperal infection, with 34 deaths. In 6 of the latter there were no clinical signs of any infection outside of the uterus, but the autopsies revealed nephritis, purulent thrombosis, or other serious lesions in all but 2 cases. Consequently, out of the 34 fatal cases, probably 2 might have been saved by hysterectomy. He holds that there is no absolute indication for the performance of this operation.

When abscesses form in one or other of the pelvic tissues and their presence is clearly indicated, evacuation of the pus is necessary. This should be carried out by the vaginal route if possible even when the tubes and ovaries are

infected. Removal of diseased tubes and ovaries by the abdominal or vaginal incision is very risky while the tissues are invaded with active infective organisms. This radical procedure should be deferred as long as possible.

When general septic peritonitis is present, the treatment is the same as in nonpuerperal varieties of this affection.

Within recent years considerable attention has been given to the subject of serum-therapy in puerperal infection. In 1891 Lingelsheim and Roger, and in 1893 Mironnoff, believed that they partly succeeded in immunizing animals against streptococcus. In 1895 Marmorek reported that by growing streptococcus on blood-serum and agar and inoculating animals repeatedly, so as to obtain a very virulent culture, he was able, by injecting this culture into immune animals, to produce a preventive and curative serum. Charrin and Roger at the same time reported a similar serum, obtained in a somewhat different manner.

Many reports have appeared in different countries regarding the hypodermatic injection of antistreptococcic serum. Glowing accounts of single cases in which improvement followed its employment have been given in many journals; they are mostly worthless. Accurate studies of many cases by skilled observers make it evident that no better results have attended the use of the serum than have followed other methods of treatment. In 1899 a committee of the American Gynecologic Society issued a report on this subject. They collected 352 cases of puerperal infection in which the serum had been used. Of these, it was certain that there was streptococcic infection only in 101 cases, of which 33 died, or 32.69 per cent. Krönig has treated 56 and Williams 52 cases of streptococcic endometritis without the serum, with a mortality of less than 4 per cent. The author has treated more than 160 cases with little more than 5 per cent., the mortality being chiefly due to peritonitis. If it be admitted that the antistreptococcic serum may do good in cases of streptococcic infection, it is irrational to suppose that it is valuable where other organisms are the cause of trouble. Yet it has been used indiscriminately, and success has been claimed for it in saprophytic as well as in the various forms of septic infection, when improvement has been undoubtedly due to other factors. Bar and Tissier have called attention to the various complications that have followed the use of the serum—*i. e.*, distress, malaise, shivering, rise of temperature, erythema, urticaria, pains in joints, effusion in joints, and abscess.

Hofbauer has advised the use of nuclein, claiming that it increases the number of leukocytes and so leads to improvement.

2. Nonpuerperal Metritis.

Pathologic Anatomy.—In an acute inflammation the endometrium is swollen and congested. The epithelium on the surface or lining the glands may be destroyed in various places. In the interglandular tissue many leukocytes may be found, as well as extravasations of blood. Sometimes the mucosa may be somewhat separated from the muscular part of the wall by exudate. When the gonococcus is present, it may be found within and outside the cells.

When the musculature is considerably involved, the uterine wall is thick-

ened and softened and may sometimes have a pulpy consistence. It is deeply congested, and blood extravasations may be seen in parts. Inflammatory products are exuded among the muscular bundles. If pus-formation has taken place, small foci are noticed throughout the wall. The peritoneal surface may also be involved and may become adherent to surrounding structures. Acute metritis may lead to a chronic inflammatory condition, in which thickening and hardening of the connective-tissue elements prevail; or a chronic purulent condition may be left, abscesses being present in the uterine wall, and sometimes in the adjacent parametrium, tubes, and ovaries. Rarely, abscess of the wall may extend into vagina, bladder, intestines, or abdominal wall.

Sometimes rapid resolution and recovery may occur. At times death

occurs from the virulence of the infection causing the inflammation.

Physical Signs.—

There is tenderness on bimanual examination of the pelvis, and there may be great pain when the peritoneum is affected. The abdominal walls may be very tense and resistant, varying according to the amount of peritonitis. There is often free leukorrheal discharge, which may be blood-tinged. The uterus is enlarged and softer than normal.

Symptoms.—

There is fever, which may be accompanied with chills. The patient has a sensation of heat and fulness in the pelvis.

Pain is felt, most in-

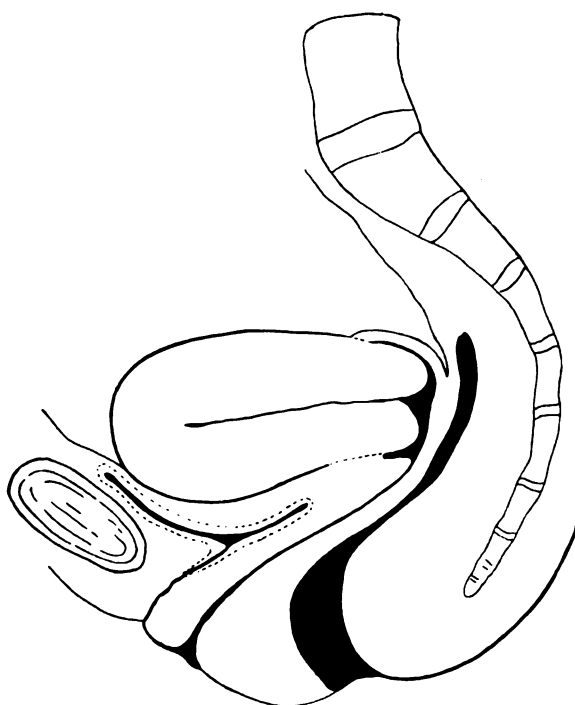


Fig. 254.—Enlarged metritic uterus (so-called "anteverted").

tense when there is peritonitis, and it is usually aggravated by movement, micturition, and defecation. There may be rectal and vesical tenesmus. The stomach is frequently disturbed in its function. Menstruation is usually suppressed or diminished; sometimes increased.

Treatment.—The patient should rest in bed. An ice-water coil or an ice-bag should be applied to the lower abdominal region. The diet should be simple. In the case of a gonorrheal infection, it is advisable to insert a strip of gauze into the uterine cavity soaked in a solution of formalin (water, 16 oz.; glycerin, 4 oz.; formalin, 1 dr.). This should be left in position twelve hours and renewed three or four times during the first week. When the gauze is out,

the vagina should be douched twice daily with a formalin solution half the strength just mentioned. As the acute stage subsides, ichthyol-glycerin (1:10) tampons may be inserted into the vagina every day or two for two or more weeks.

CHRONIC METRITIS.

1. Chronic Cervical Catarrh; Cervical Endometritis; Endocervicitis.

This form is especially due to infection following lacerations of the cervix; it may also extend from inflammation in the endometrium of the corpus uteri and may be due to gonorrheal infection.

Pathology.—The inflammatory process affects all parts of the mucosa, chiefly the glands and epithelium.

Hyperplasia and increased folding of the mucosa take place, and as the process extends outside the os externum, the stratified epithelium covering the vaginal portion tends to be displaced by columnar epithelium. The glands also increase and extend downward in the cervix; the outlets of many may become closed, giving rise to retention cysts—Nabothian follicles. These may sometimes form small polyps projecting from the cervix; they may contain one or more loculi. In some cases a



Fig. 255.—Thickened cervix in a multipara with catarrhal areas and Nabothian follicles.



Fig. 256.—Papillary erosion ($\times 494$).

Nabothian follicle bursts, leaving a moist, secreting area. When the disease is extensive, the lower part of the cervix may become converted into a mass of cysts. The connective-tissue elements are increased as the inflammation proceeds, and the cervix may be greatly thickened and sometimes elongated.

Sinclair, of Manchester, points out the constant association of erosion and hypertrophy of the posterior cervical lip with chronic retroflexion. He has shown that reposition of the

uterus is followed by gradual disappearance of these changes—the erosion

first and the hypertrophy afterward. He considers amputation illogical and unnecessary in such cases.

■ On microscopic examination the patches of inflamed mucosa present the following appearances:

1. The folds and recesses may be long and narrow—the papillary variety.

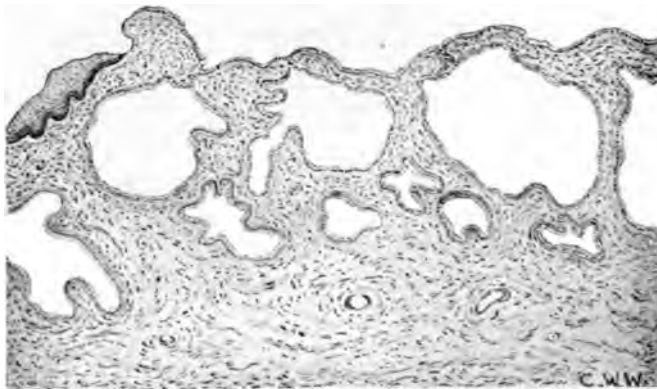


Fig. 257.—Follicular erosions, showing occluded glands distended with mucus ($\times 31\frac{1}{2}$).

2. They may be short, the recesses being often broad and irregular, formed by the bursting of retention cysts. In both forms the covering epithelium is a single layer of columnar cells smaller than those of the normal mucosa.

In rare forms of inflammation the superficial epithelium may be destroyed, forming a true ulcerated surface.



Fig. 258.—Erosion of cervix, which has healed by extension of stratified epithelium over the former diseased surface.

Physical Signs.—On physical examination various conditions may be found. In a nullipara, if the disease is at all marked and has extended outside the os externum, the margins of the latter feel soft and velvety; in a multipara, in addition, the cervix and os are enlarged, and there are evidences of laceration. Shot-like nodules or larger masses formed by retention cysts may be felt with the

finger. They may be felt as hard, raised areas on the surface, or, rarely, as polypoid projections. Occasionally the velvety area bleeds slightly on being pressed with the finger-nail. Abundant tenacious mucus may be felt about the os.

On examining the cervix with a speculum, the enlargement of the cervix is

noted. The inflamed or catarrhal patches appear as bright red, granular, secreting surfaces. (These patches have long been known by the term "erosion" or "ectropion." For a long time they were wrongly thought to be ulcers.)

Symptoms.—There is a mucopurulent, white or yellow discharge in most cases. It may sometimes be tinged with blood, and also may be occasionally colored by certain color-producing organisms.

There is often pelvic distress, *e. g.*, vague dragging pains, or back and loin pains, aggravated by exercise.

Menorrhagia is found in some cases, probably mainly depending upon the amount of involvement of the mucosa of the corpus uteri. Irregularity of menstruation is often found. As the patient gets more and more run down, some degree of amenorrhea may be found. In many cases the patient gradually loses health, gets unfit for her duties, and may become neurasthenic. These changes are more frequent, however, when the uterus and adnexa are considerably involved. The condition tends to prevent conception in marked cases.

Differential Diagnosis.—The condition must be diagnosed from mere vaginal or vulvar leukorrhea.

Endometritis may cause similar symptoms, but in the latter condition none of the physical signs relative to the cervix may be present.

Early malignant disease of the cervix may simulate endocervicitis, *i. e.*, in the hard areas in the latter condition, caused by Nabothian follicles. At a later stage the profuse discharge might be mistaken for the leukorrhea of endocervicitis; it is, however, often disagreeable in odor, and mixed with more or less blood.

In doubtful cases a small portion of the affected area should be excised and examined microscopically.

Simple laceration of the cervix may sometimes be wrongly diagnosed as endocervicitis. This is apt to be the case if it be examined with a tubular or valvular speculum. The os may appear to gape, and a red, velvety area be seen, resembling the catarrhal patch; this is merely the normal mucosa, exposed by the separation of the edges of the tear in the cervix.

If in such a case the edges be brought together by volsella, the redness disappears, whereas if a true catarrhal patch exists external to the os, it cannot be made to disappear in this way.



Fig. 259.—Cervix of a multipara with catarrhal area around the os externum.



Fig. 260.—Two small mucous polyps projecting from the cervix.

2. Corporeal Endometritis; Endometritis.

Pathology.—The inflammatory changes affect the glands, the lining epithelium, and the interglandular tissue. According to the predominance

of the tissue affected the varieties are denominated. Thus, Ruge makes the division as follows:



Fig. 261.—Uterine mucous polyp ($\times 69\frac{1}{2}$).

Glandular.
Interstitial.
Mixed.

In the glandular variety there are both a hypertrophy and a hyperplasia of the glands, the latter taking place mainly by lateral outgrowths of old glands; it is doubtful if new ones grow inward from the surface epithelium, as some state.

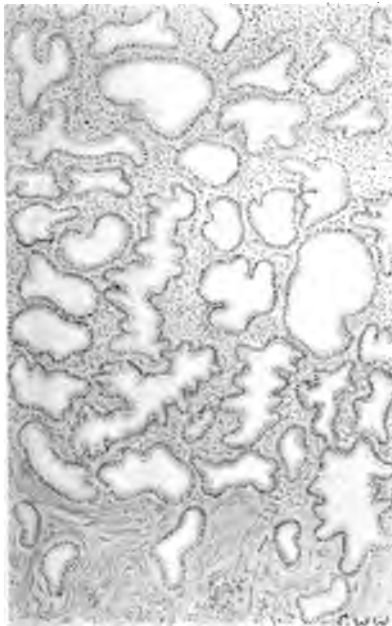


Fig. 262.—Hyperplastic glandular endometritis ($\times 49\frac{1}{2}$).

The thickened mucosa may form irregular elevations of various shapes—the appearance which led Olshausen to apply the term *endometritis fungosa* to this condition.

Many of the glands have, on longitudinal section, a serrated appearance. Marked distortion may occur. Projections of the mucosa may assume polypoid forms—the so-called “mucous polyps.”

Until recently these mucous polyps have been described by many authors as benign adenomata. Certainly, there is good reason for the use of the latter term, judging from the histologic appearance of some of the polyps, in which the glands are so increased that the intervening interstitial tissue is reduced to a minimum, no trace of inflammatory changes in it being visible.

In the interstitial variety the interglandular connective-tissue elements are most affected.

The ordinary changes of chronic inflammation are found, the tendency to

the formation of spindle-shaped cells and dense tissue in old cases being prominent; often the large cells may somewhat resemble epithelial cells. The glands may become pressed upon and obliterated. Sometimes small retention cysts are formed. These may sometimes cause projections of the surface. In these cystic distentions the lining epithelium may be flattened.

In mixed forms the above changes are found in various proportions.

In old-standing endometritis the mucosa gets atrophied and gradually destroyed, being replaced by firm connective tissue. Opposite sides of the lumen may blend, sometimes causing complete atresia. These changes occur chiefly in the senile uterus, in which accumulation of mucus or pus may take place above the atresia.

Occasionally inflammation in the mucosa leads to a destruction of the lining epithelium and to the formation of granulation-tissue, which may in parts become polypoid.

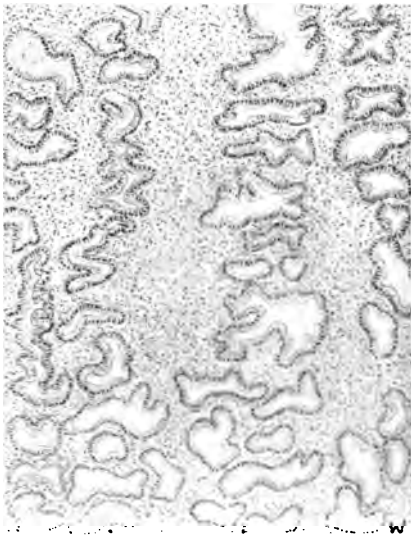


Fig. 264.—Hypertrophic glandular endometritis ($\times 404$).

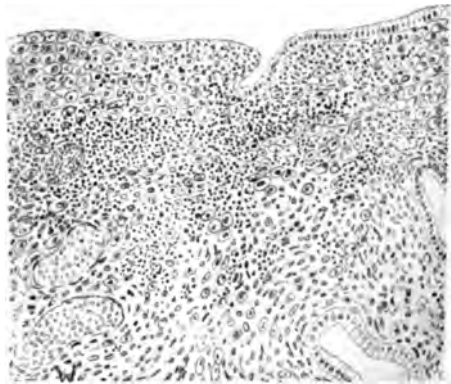


Fig. 263. Section through a portion of uterine mucosa several weeks after abortion. Interstitial endometritis is present. A number of decidual cells are seen ($\times 80$).

In some cases of endometritis there is a special tendency to extreme congestion and dilation of the blood-vessels—hemorrhagic endometritis. It is extremely difficult to say which one of these conditions is present from clinical examination. Microscopic investigation of scrapings is important in enabling one to arrive at a conclusion.

When endometritis occurs soon after the pregnant uterus is emptied, especially after an abortion, the connective-tissue cells tend to be of large size—the decidual type. Remains of chorionic tissue may also be found—*e. g.*, syncytium on or below the surface, or portions of villi attached to the surface.

Physical Signs.—The uterus is usually enlarged, especially if there be much associated inflammation in the muscular part of the wall.

It may not be easy to make out slight degrees of enlargement by the bi-

manual examination; this can be determined by the passage of the sound. On introducing this instrument, slight bleeding may result; there may be tenderness and irregularities may be felt. In many cases, however, none of these signs are present.

Endocervicitis may often be present, or other conditions, *e. g.*, cellulitis, local peritonitis.

Differential Diagnosis.—Endometritis causing a profuse leukorrheal discharge must be diagnosed from vulvar or vaginal conditions which produce a similar discharge, or from endocervicitis. Careful inspection usually suffices to detect any affected area below the level of the external os.

Endometritis associated with menorrhagia or metrorrhagia must be distinguished from new-growths of the uterus.

A small submucosal fibroid may be the cause of hemorrhage and may not readily be detected on bimanual examination. Scrapings of the mucosa may

present evidence of endometritis, and thus the tumor may be overlooked. It may not be found until later, when it has enlarged or when the cervical canal has been dilated so that the cavity may be palpated with the finger or sound.

Malignant disease may also be simulated by hemorrhagic metritis. The diagnosis is not difficult when the carcinoma or sarcoma is well advanced, for, apart from the clinical features, the examination of the uterine cavity with the finger usually suffices to establish the character of the trouble, irregular, friable, bleeding masses being present when there is malignancy. The



Fig. 265.—Section of a fragment cureted from the uterus after an abortion. Decidual cells, glands, and extravasated blood-corpuscles are seen ($\times 450$).

microscopic study of scrapings usually suffices to establish a diagnosis.

In the case of early malignant disease of the uterine body the diagnosis may be difficult. The examination of portions removed by the curet is not always conclusive, especially in the case of malignant adenomata and sarcomata. A portion of endometrium presenting marked glandular hyperplasia may, on section, resemble an adenoma, but the gland type is always preserved. In the malignant adenoma there tend to occur irregular groupings of strands of cells, and the latter may not have the cylindric shape, but may be cubic or irregular in outline. No membrana propria may be found external to the epithelial strands, and the latter may lie close together. Such a malignant growth tends to extend into the muscle, but this cannot be determined by curetage.

Carcinoma may more readily be detected in scrapings. The appearances are described on pp. 559, 560. One important feature presented by the cancer growth is a breaking through the membrana propria by the cells as they invade

the connective tissue. Orth states that "the presence of irregular alveolar cavities filled with epithelial cells or of reticulated epithelial cords, perhaps with pearls, is proof of carcinoma and demands total extirpation; while various forms of proliferation in the glands situated in the general tissue groundwork, twistings, dilations, formations of papillary, protruding folds in the lumen, and even filling the lumen with cast-off cells, do not of themselves permit a positive diagnosis of malignancy."

Certain scrapings of interstitial endometritis may resemble sarcoma, and the latter may, in the early stages of growth, be overlooked. The glands may early be penetrated or destroyed by sarcoma and its cells tend also to break into vessels. No inflammatory changes are present in the sarcoma, as a rule, and after curetage there is usually quick recurrence.

Chorio-epithelioma is characterized by the presence of syncytium, Langhans' cells, or villus-like structures in the scrapings (see p. 596).

Symptoms.—Increased menstruation is the most common symptom. This is especially marked in the hemorrhagic type, and, as a result, the patient may become very anemic, weakened, and sometimes cachectic. There may be increase both in the duration and in the quantity, and in some cases there may be loss of blood between times. When the patient has become debilitated, menstruation may become scanty.

Leukorrhœa is very common. The discharge is not usually so gelatinous as that produced by the cervix. It is more serous or seropurulent, and may be somewhat blood-tinged.

Dysmenorrhœa is frequently present. In some cases this is undoubtedly due to associated inflammatory conditions, *e. g.*, metritis, salpingitis, etc., but in many cases I believe it to be due to abnormal clotting of blood in the uterus, fibrin-formation, or to the shedding of abnormally large bits of mucosa as a result of the inflammatory changes; these masses interfere with the free escape of the menstrual blood and cause reflex contractions of the uterus (see "Dysmenorrhœa," p. 126).

Weakness and pains in the back and pelvis are common. A feeling of general weakness and incapacity for work, anemia, various nervous derangements, and digestive disorders are found in well-pronounced cases. Sterility may result, or, if pregnancy occurs, there may be recurring hemorrhages and abortion.

3. Inflammatory Changes in the Muscular Part of the Wall; Parenchymatous Metritis; Metritis.

Pathologic Anatomy.—When it follows an acute process or begins after labor, the uterus is at first enlarged, softened, and congested, and later becomes gradually indurated and pale. The enlargement is uniform.

On microscopic examination, in the early stage, the vessels are congested, and many leukocytes and proliferating connective-tissue corpuscles are found between the muscular bundles. Later, the blood-vessels are contracted and their walls thickened, the lymphatics being often dilated. There is an increased quantity of dense fibrous tissue between the muscular bundles, and the latter gradually tend to become compressed and destroyed. In the endometrium the various chronic inflammatory changes described may be in process. The peritoneum may be found thickened or adherent.

Physical Signs.—In the early stage the uterus is felt bimanually to be uniformly enlarged and somewhat softer than normal; in the later stages it is enlarged and hard. It may be movable, fixed, or displaced. On passing the sound, its cavity is found to be enlarged.

Symptoms.—Menstruation is altered in various ways, mainly depending upon the condition of the endometrium. Menorrhagia and metrorrhagia are very frequent. The discharges of blood may be very irregular in some cases. When the patient is much debilitated, there may be some degree of amenorrhea. Dysmenorrhea is often present. There is a tendency to abortion. In marked cases sterility is the rule, though in many cases this may be due to coexisting inflammatory changes in the ovaries or tubes. There is a feeling of weakness, dragging, or heaviness in the back, pelvis, or loins, and pains are often felt. There may be distress and frequency in micturition.

There are usually more or less marked reflex and sympathetic disturbances, and various neuroses may be established.

Differential Diagnosis.—It is often difficult to establish a diagnosis between metritis, early pregnancy, metritis in an early pregnant uterus, and a uterus enlarged as a result of a small fibromyoma (see p. 526).

Treatment of Chronic Uterine Inflammation.—Treatment, as a rule, is difficult and unsatisfactory. It can only be satisfactorily accomplished when the patient submits herself to the most diligent carrying out of the measures recommended. Spasmodic or unsystematic efforts are bound to end only in disappointment both to patient and physician.

General Measures.—It is of the greatest importance to attend to the general health of the patient. The diet should be regulated so that the stomach and bowels perform their functions well. Constipation is to be avoided. Various mineral waters are used for laxative purposes, *e. g.*, Villacabras, Rubinat, Birmenstorf, Hunyadi János, Friedrichshall. If the patient be run down, it may be necessary for her to discontinue her ordinary activities. Often it is best to send her away from home for a complete change. Patients often improve considerably at watering-places, where there is a strict regimen. Sometimes it is advisable to make the patient rest on the flat of her back, with the lower part of her body elevated, for a couple of hours in the afternoon. She must not be allowed to become too inactive, however, and should be encouraged to take regular open-air and indoor exercises of a gentle nature.

At menstrual periods the patient should take an extra amount of rest. Coitus is to be avoided as much as possible during treatment.

Certain drugs may be necessary in some cases, mainly of a tonic nature, *e. g.*, iron, arsenic, cod-liver oil, strychnin. Potassium or sodium iodid is recommended strongly by some authorities to bring about a reduction in size of the uterus, but it acts very slowly. It may be especially valuable where there is a rheumatic taint, but it is not to be used if the patient be much depressed or debilitated. Sodium or potassium bromid is often used along with the iodid, where there is much pain or nervous irritability; it is important, however, to avoid the indiscriminate use of the bromids, and they should be withheld in all cases where there is a considerable neurotic complication. Potassium chlorate with hydrochloric acid has also been recommended.

Various of the medicinal waters are of value in many cases, *e. g.*, the sul-

phated alkaline waters of Franzensbad, the muriated waters of Kreuznach, Woodhall Spa, Kissingen, Reichenhall, the muriated alkaline waters of Ems, Royat, etc. Iron waters are given at Spa, Schwalbach, Pyrmont, etc.

When there is menorrhagia or metrorrhagia, ergot may be given for some weeks, being increased at the menstrual periods.

In every instance the patient should be encouraged and strengthened in every way; she should be made to keep her thoughts from her local condition. If she be very neurotic, strict disciplinary measures may be necessary, and, in some cases, it is advisable to put her under the Weir-Mitchell treatment.

Believing that the great majority of these chronic inflammations are due to residual infection of microbial origin, we must use measures to promote nature's method of getting rid of the irritant, mainly by the activity of the blood and lymph circulation.

Local Measures.—It is important, therefore, to aim at relief of congestion and stimulation of the circulation. Where the uterus is somewhat enlarged and tends to drag down or prolapse, a pessary may be introduced to support the uterus for a time. This is especially necessary if the organ tend to be retroverted.

Vaginal douching is of great value when thoroughly carried out (*vide* p. 191), the temperature of the water being about 110° F.

When there are slight endometritis and endocervicitis, it is well to complete the douche with an astringent lotion, *e. g.*, formalin ($\frac{1}{2}$ dr. to a pint), sulphate of copper, or alum (2 dr. to a pint) solution.

Hot hip-baths of salt water given at night from time to time are often valuable in diminishing pelvic pain, especially before menstruation. If the patient is debilitated, it is not well to employ them.

A cold bath in the morning is a valuable stimulus to the circulation. Vaginal tampons soaked in glycerin or in ichthyol glycerin (1:10-20), placed in the vagina against the cervix, may relieve congestion considerably by causing a free flow of watery discharge from the uterus. These may be introduced every second or third evening and left in position all night.

When the leukorrheal discharge is not checked by these measures, applications of iodine, iodized phenol, perchlorid of iron, or glycerin and phenol in equal parts, may be made in the interior of the uterus two or three times during the course of a month. It is best to begin during the week after menstruation. If an application be made too near the onset, it is apt to bring on the flow prematurely.

Counterirritation by means of blisters over the iliac regions is often beneficial.

In many cases it is more expeditious to curet the uterus thoroughly. The importance of thorough removal of possible sources of infection in inflammation of the uterus cannot be too strongly urged. If a diseased mucosa be left as a constant source of irritation, progress will be very slow. Where slight endocervicitis exists, with the formation of a catarrhal patch, the diseased surface should be scraped away, the Nabothian follicles emptied, and iodized phenol applied. Each day afterward the vagina should be douched with an astringent antiseptic douche. In bad cases, where the cervical mucosa is much diseased, cureting should be followed by an operation for the removal of the diseased part. This is best carried out by Schroeder's method, as follows:

The cervix is drawn down and steadied with a volsella and divided as high as is necessary into an anterior and posterior half. A transverse incision is then made across the mucosa of the latter above the disease, and another is carried up from the extremity of the lip to meet the first one. In this way a strip of diseased mucosa is entirely removed. The raw lip is then bent upward on itself, the lower part being approximated to the intact mucosa, and three or four chromicized gut stitches applied.

The anterior lip is treated in the same way. The sides of the first incision are then secured with a stitch or two, and the after-treatment is the same as that following curetage.

In hemorrhagic cases it is advisable, after cureting, to swab the cavity with a strong solution of perchlorid of iron and then to introduce gauze for twenty-four hours.

After these operations the patient should be in bed for at least eight days. At the following menstrual period there is apt to be an excessive discharge of blood, and it is advisable for the patient to rest a good deal and to take ergot internally.

In extreme cases of metritis, where the uterus is much enlarged, in addition to cureting the mucosa it is advisable to amputate one or both lips of the cervix by the method described on p. 467. This has been especially advocated by Martin, of Greifswald, as a means of improving the condition of the uterus. Galvanic electricity is employed by some to reduce the size of the uterus (see p. 205).

In cases where acute metritis has been followed by a purulent condition in different parts of the wall, extirpation of the uterus along with the tubes and ovaries, which may be similarly affected, is justifiable.

STENOSIS OF THE CERVICAL CANAL.

Narrowing of the cervical canal may be found at the os externum, the os internum, at both of these, or in the whole length of the canal. Most frequently the first two varieties are found. The condition may be a congenital one, and in these cases it may be found with defective development of the uterus, or with an elongated cervix. It may be due also to contracture following labor, to operations on the cervix, *e. g.*, amputation, or to the application of strong caustics. It may sometimes follow inflammatory changes in the cervix. The irritation of a pessary has been known to lead to it. It may be a natural change in advancing age. It is important to remember that stenosis may cause more or less interference with the delivery of a child in labor.

Symptoms.—Dysmenorrhea may be caused. Normally, during menstruation, some dilation of the cervical canal takes place. If this be prevented it is possible that the obstruction to the menstrual outflow may lead to the development of pains.

In many of these cases the pains are due to associated conditions, *e. g.*, clotting of the blood *in utero*, *i. e.*, fibrin-formation, the shedding of abnormally large bits of uterine mucosa as a result of inflammatory changes in the uterine wall.

Often the pains are due to a neurotic condition. (For a full consideration of dysmenorrhea in relation to stenosis of the cervix see p. 124.)

Sterility may also be common in these cases, but probably, in many instances, it is not the stenosis, but some associated condition, *e. g.*, inflammation, which is the cause. Neurotic complications are often present.

Physical Examination.—The condition of the cervix may sometimes be distinguished by the finger when the os externum is affected. It is usually necessary to use a probe or sound in order to determine the degree of stenosis.

It is important to note that the sound may be obstructed by a uterine flexion, a fold of the mucosa, a polyp, or a reflex contraction of the muscle around the os internum.

Sometimes the cervical canal may become distended with mucus when the stenosis is at the os externum.

Treatment.—When there is a stenosis of the cervical canal, some method of permanently enlarging it should be carried out. This treatment should always be associated with energetic measures to improve other diseased conditions which may be present. When there are inflammatory changes in the uterus, curetage is usually advisable.

The following operative measures may be recommended:

Instrumental Dilation.—After being placed in the lithotomy position prepared, the cervix is pulled down by means of a volsella, and the size of its canal estimated by the sound; a series of graduated dilators are passed into it until the stenosed portion is well stretched. Along with these an expanding dilator, *e. g.*, Goodell's, may be used.

Incision.—It is generally best to divide the stenosed portion as well as to dilate it. In the case of a small external os, this may be carried out with a pair of scissors or an ordinary knife, the cervix being steadied with a volsella.

The posterior lip may be divided in the middle line, or the cervix may be divided on each side. The depth of the incision is usually about three-eighths of an inch.

In the case of stenosis of the whole canal or of the internal os, after dilation, a narrow-bladed knife is passed up the canal, and the wall at the internal os incised first on one side and then on the other. If the whole cervical canal is narrowed, each of these incisions can be extended down through the whole length of the cervix. The incision extends through the whole thickness of the mucosa and into the muscle.

The after-treatment in these cases is important. The denuded surfaces should be swabbed with iodized phenol, formalin, or perchlorid of iron solution, and they should be kept apart by a small glass tube or by a plug of gauze. These should be changed every second day for a week. Afterward, for ten days, the os should be kept open by means of graduated dilators.

Excision.—In cases of stenosis of the external os this operation is preferred by some.

The cervix is pulled down with a volsella, and is split on each side for half an inch. Out of each of these portions a wedge-shaped piece is cut with a knife. The raw surfaces in each lip are then closed by chromicized catgut sutures, the edge of the cervical mucosa being joined to that of the vaginal portion. The lateral incisions are then closed. At the end of the operation, instead of the small os externum, there is left a large gaping one.



Fig. 266. — Elongated conic cervix.

ATRESIA OF THE CERVIX.

This may be congenital or acquired. The former of these is considered on p. 440.

Acquired atresia may follow cicatrization after injury in labor, cauterization of the cervix, amputation, ulceration; it may be found in the senile uterus; with tumors of the cervix; as a result of the irritation of a pessary; sometimes in prolapsus uteri.

If the patient has not passed the menopause, distention of the uterus or tubes, or of both, with blood may result. As the uterus distends, the endometrium is thinned and fibrin is deposited on the surface. The blood contains abundant mucus and does not tend to clot. It forms a thick, viscid brown

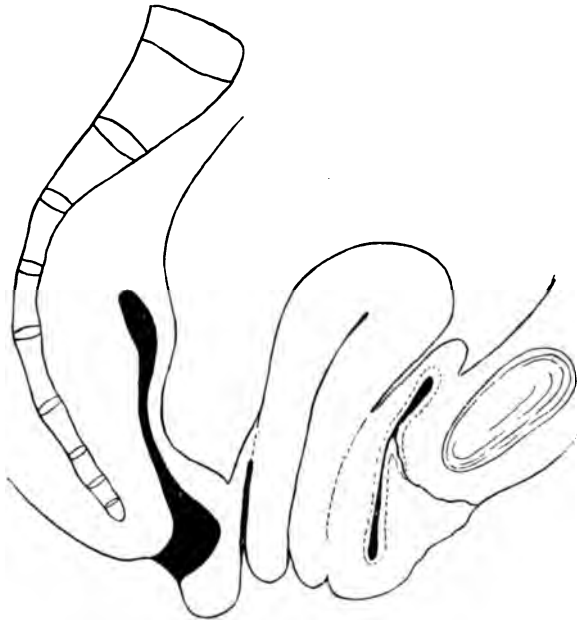


Fig. 267.—Hypertrophic elongation of intermediate portion of cervix.

or black fluid. Sometimes it may become infected, and a collection of pus may result; occasionally it may contain gas, probably due to the action of a gas-producing organism. After the menopause, a collection of pus may sometimes be found in the uterus.

Treatment.—An opening must be made in the cervix. The incision is made by means of a sharp knife, the cervix being steadied by means of a volsella. A small circular portion may be cut out, and the raw surfaces swabbed with perchlorid of iron solution. The after-treatment is important. A glass tube should be worn for a few days, in order to prevent the part from closing.

HYPERTROPHY OF THE CERVIX.

Hypertrophy of the uterus is found in two forms, namely, general increase in size, especially transversely, due to inflammation and hypertrophic elongation. The latter will alone be considered under this heading. The following forms are met with:

Hypertrophic Elongation of the Vaginal Portion.—In this condition the portion of the cervix within the vagina is elongated; in some cases it may extend beyond the vulva. There is usually no transverse increase.

On bimanual examination the uterus is elongated, that part of it above the vagina being of normal size and shape, and the fundus being in its normal position. A large portion of the cervix is felt in the vagina.



Fig. 268.—Hypertrophic elongation of supravaginal portion of cervix.

Hypertrophy of the Supravaginal Portion.—This condition may be primary, though generally it is secondary to prolapsus uteri.

On bimanual examination the uterus is found to be elongated. As the hypertrophy increases, both fornices tend to become obliterated. It is impossible to say whether the body of the uterus may not be involved in these cases, because it is difficult to determine clinically where the os internum is situated. There may be stenosis of the cervix. In an advanced case the bladder is greatly lowered as well as the pouch of Douglas.

Hypertrophy of the Intermediate Portion.—Sometimes the hypertrophy may affect mainly the intermediate portion of the cervix. As it increases, the anterior fornix tends to become obliterated, the posterior remaining. The bladder becomes lowered.

Symptoms.—In slight cases there may be no symptoms. In other cases there may be dysmenorrhea and sterility. In marked cases there may be a feeling of dragging or bearing down, discomfort, or pain. There may be



Fig. 269.—Hypertrophic elongation of vaginal portion of cervix.

micturition and defecation troubles, and trouble on walking. Leukorrhea may be excessive, and may result from irritation of the vaginal walls. If the cervix projects from the vulva, it may become ulcerated.

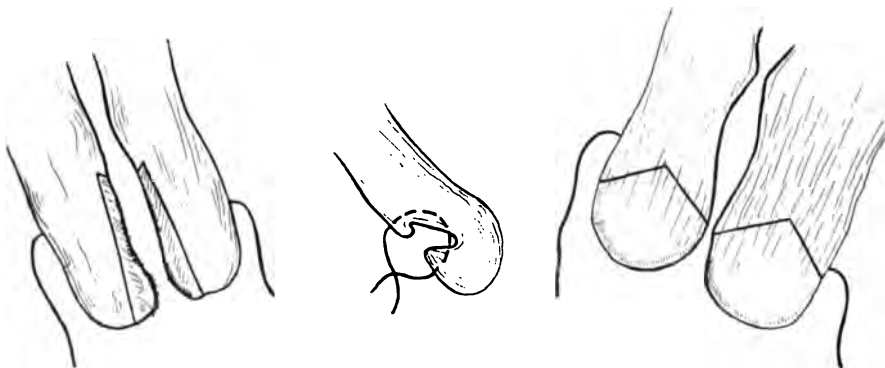


Fig. 270.—Schroeder's excision of diseased cervical mucosa.

Fig. 271.—Line of incision in Martin's amputation of the cervix.

Treatment.—Amputation of part of the cervix should be carried out, either of two methods being employed.

1. **Flap Amputation, by Removal of Wedge-shaped Portions from Anterior and Posterior Lips.**—The patient is placed in the lithotomy position. A short, wide, spatular speculum is placed posteriorly in the vagina. The cervix is pulled down with a volsella and the length of the uterine cavity measured, so that the amount of tissue to be removed may be estimated. The cervix is then divided on each side as high as is desired,—it may be half an inch or more,—so that anterior and posterior flaps are formed.

The anterior lip is then held with a volsella by an assistant, while a transverse incision is made across the mucosal surface of the posterior lip some distance below the upper limit of the lateral incisions, the edge of the knife being directed inward and upward. A second transverse incision, beginning on the outer surface of the lip, extends upward to meet the first transverse cut. In this way a wedge-shaped piece of tissue is removed.

The raw surfaces in the lip are then brought together, the mucosa of the cervical canal being approximated to that of the vaginal portion of the cervix, a series of interrupted chromicized catgut sutures being used.

A corresponding wedge-shaped portion is then removed from the anterior lip, and the raw surface closed. The anterior and posterior lips are then brought together laterally by means of catgut sutures.

The vagina is then cleansed and a tampon of antiseptic gauze placed in it. After twenty-four hours the plug is removed, and an antiseptic warm douche is given. This is repeated daily. By the tenth day the patient may sit up.

2. **Circular Amputation.**—The cervix is pulled down with a volsella. A circular incision is made through the mucous membrane covering the vaginal portion of the cervix just where the outer surface turns inward



Fig. 272.—High amputation of cervix. The flap of mucosa is stripped upward from the cervix and the latter is split into an anterior and a posterior portion.

toward the os externum. The mucous membrane is stripped up above this incision, leaving bare the musculature of the uterus. The upper limit is



Fig. 273.—High amputation of cervix. A portion of the cervix has been removed.

decided by the amount to be amputated. The cervix is then divided into an anterior and a posterior part as high as the line of amputation. The posterior lip is then cut across somewhat obliquely, so as to leave a thin flap on the mucosal side. The stripped-up mucosa is then turned over the stump, and its edge stitched to the thin flap next the cervical canal. Separate chromicized catgut sutures are used.

The anterior lip is treated in the same way. On each side of the canal the gaping redundant portions of the stripped-up mucosa should be closed by catgut sutures. Finally, the cervical canal should be examined to see that it has been left quite patulous.

The *after-treatment* is the same as that described for the last operation.

In those cases in which the relations of the bladder and pouch of Douglas are altered, care must be taken not to open into them in operating.

ATROPHY OF THE UTERUS.

This condition is found—

1. As a congenital condition (*vide* p. 437).
2. Associated with certain debilitating conditions, *e. g.*, chlorosis, tuberculosis, syphilis, diabetes, Bright's disease, morphinism, etc.
3. After the menopause.
4. After delivery, as a result of superinvolution. Here great loss of blood or overlactation may lead to the condition; or, perhaps, pelvic inflammation causing destruction of the ovaries or interfering gradually with the nutrition of the uterus.
5. Sometimes it follows amputation of the cervix.

Pathology.—The uterus is reduced in size. The cavity may be under 2

inches in length. The walls may be thin and flaccid, or tough and fibrous. The ovaries may or may not be atrophied.

Diagnosis.—The chief feature is amenorrhea. There may be associated pelvic pains due to accompanying inflammatory conditions or to a neurosis. There may be a poor condition of health and reflex neurotic phenomena.

On physical examination, the uterus is found to be small. This is also made out by means of the sound, which must be used with great care. The condition must be distinguished from malformations of the uterus.



Fig. 274.—High amputation of cervix. Appearance of cervix at end of operation.

Treatment.—Treatment is unsatisfactory. The general health must be improved and tonics administered, *e. g.*, iron, strychnin. Locally, hot douches may be used. The uterus may be stimulated by the frequent passage of a sound.

LACERATION OF THE CERVIX.

Pathology.—Lacerations result from labors, especially from those which are tedious or precipitate, or from operative procedures on the uterus. The

former are by far the most common cause. They may occur in connection with premature as well as full-time deliveries. Lacerations may be found in all parts of the cervix. Most frequently the left anterior portion is torn (to be associated with the most common position of the head in labor, viz., *occipito læva anterior*). Bilateral laceration is not infrequent. Sometimes the presence of several tears may give a stellate appearance to the cervix. All degrees of laceration may be found from a slight notch to a deep fissure extending into the fornix. Sometimes a ureter may be involved.

Results of Laceration.—There may be slight or considerable bleeding at the time of tearing or afterward. The raw surfaces usually heal quickly, becoming covered with epithelium. If they become infected, inflammation may extend into the uterus, its adnexa, pelvic peritoneum, or cellular tissue, a process usually associated with subinvolution of the uterus. Sometimes, acute and serious infective processes may occur; frequently, they are slight and chronic. Laceration of the cervix is, probably, of little importance, apart from providing a raw area through which infecting micro-organisms may enter the tissues. It was formerly believed that the compression of nerves by the scar tissue succeeding the tear was important in causing local pelvic distress and various neuroses. This view is not now generally held.



Fig. 275.—Cervix of a multipara.

Symptoms.—A severe laceration may cause considerable loss of blood, but in ordinary cases this is not a marked feature. When the laceration is healed, it produces no direct signs or symptoms. If there are associated inflammatory or other diseased conditions in the pelvis, a variety of symptoms may be present, *e. g.*, menorrhagia, metrorrhagia, leukorrhea, pelvic pain or distress, reflex and neurotic disturbances.

Diagnosis.—On digital examination the laceration may be felt. If it be extensive and the mucosa everted, the cervix may appear to be simply much thickened. Through a speculum the exposed mucosa is visible. If there be no catarrhal patch external to the os externum, the red area may be made to disappear if the edges of the laceration are brought together; where it is present, the entire red area cannot thus be made to disappear. When inflammatory changes have resulted from the laceration, the various changes caused by them may be made out on physical examination.

Treatment.—All marked lacerations should be repaired at the time of their occurrence if the operation can be performed with a thorough technic; otherwise, several weeks should be allowed to elapse. Slight tears need not be repaired; during the healing process care should be taken to prevent infection.

In old-standing cases, a very thorough examination of the pelvis should be made in order that no pathologic condition may be overlooked. Too frequently is a cervix repaired merely because it is lacerated, when the patient's troubles are due to some associated pelvic lesion which is entirely neglected. Repair is not necessary in slight cases, except where inflammatory changes occur external to the edges of the laceration, but it is always advisable in well-

marked cases. When, however, the cervix is much thickened and contains many Nabothian cysts, amputation is advisable. When there is only slight cystic change, the latter may be dissected.

The repair operative procedure—trachelorrhaphy is carried out as follows:

(a) *Where the Tear does not Extend into the Fornix.*—The patient is placed in the lithotomy position and the cervix well exposed and drawn downward with a volsella. Curetage is carried out and then the edges of the laceration are pared with a knife, the scar tissue in the apex being well removed. The raw surfaces are then brought together by a series of chromicized catgut sutures, care being taken not to diminish the lumen of the cervical canal too greatly.

An antiseptic gauze tampon is placed in the vagina for twenty-four hours. The after-treatment is the same as in the case of curetage.

(b) *When the Tear extends into the Fornix, Lateral Displacement of the Uterus having Resulted from the Cicatrization.*—After curetage of the uterus the cervix is pulled with a volsella toward the normal side. A lateral incision is made in the affected fornix, close to the cervix, and following its curve. As the cervix is pulled toward the opposite side, the incision gapes, so that with scissors the cicatricial bands may be divided. The incision is then closed by a continuous chromicized catgut suture passed from before backward, so that the resulting line of incision remains transverse. In this way the lateral displacement of the cervix is diminished. The laceration in the latter is then closed in the manner already described. Very rarely a ureter may be injured in repairing a laceration, especially when the latter involves the fornix vaginæ. It may be cut or caught in the sutures if the latter are introduced too deeply into the tissues.



Fig. 276.—Cervix of multipara with multiple lacerations.

In cases where there is considerable hypertrophy of the cervix or of the whole uterus, or where marked endocervicitis exists, it is best to curet the uterus, and to amputate the cervix by the flap method, instead of attempting to repair the laceration.

INSTRUMENTAL PERFORATION OF THE UTERUS.

The uterus may be perforated by an instrument in the endeavor to perform criminal abortion, either by the patient herself or by another person. The result of the accident may be *nil* or may be very serious. Intraperitoneal hemorrhage may result or septic infection. Sometimes, the omentum or intestine may be injured by the perforating instrument, or these structures may descend into the uterus or even into the vagina and may become strangulated.

Perforation may also occur in the course of regular operative procedures,

even when considerable care is exercised. The accident is most likely to happen when the uterus is softened by pregnancy or sepsis or when it is atrophied. Sometimes, in such cases, the slightest pressure of a sound, dilator, or curet may lead to perforation.

If the accident takes place prior to an intraperitoneal operation, the opening in the uterus may be closed during the latter procedure with catgut. If no intraperitoneal operation is to be carried out, the cavity of the uterus should be packed with antiseptic gauze and the patient should be put to bed, ergot being administered for several days. On the third day the gauze should be removed. Any necessary operative procedures should be carried out at a later period.

If septic peritonitis develops, opening of the abdomen and drainage may be necessary. When the intestine descends into the uterus, abdominal section should be carried out. The gut should be withdrawn from the uterus, resection being necessary if marked strangulation has taken place. The opening in the uterus may be closed with catgut, but if the organ is much injured or very septic, hysterectomy may be necessary.

An interesting report of cases of this accident is given by Brothers in "American Gynecology," April, 1903.

CHAPTER XVI.

DISPLACEMENTS OF THE UTERUS.

The normal position and movements of the uterus have already been described (see p. 30). A number of variations from the normal may be produced by various causes and are termed *displacements*. Some of these are unimportant, others may be serious factors in disturbing the health of women. The following terms describe the various deviations which occur:

Anteposition, lateroposition, retroposition.

Anteversión, lateroversión, retroversión.

Anteflexion, lateroflexion, retroflexion.

Elevation, prolapse, inversion, hernia.

Anteposition is a term rarely used. It refers to a condition in which the whole uterus is displaced more anterior than normal. This displacement is usually due to some mass, *e. g.*, exudate, tumor, posterior to the organ, which pushes it forward. It may also result from the traction of adhesions to the anterior parietes drawing it forward.

Retroposition is the condition in which the whole uterus (retaining its normal anteflexion) is displaced as a whole more posteriorly than normal. This may be a congenital peculiarity; or more frequently it may be caused by pressure of a mass, *e. g.*, exudate, tumor, anteriorly to the uterus, or it may result from inflammatory cicatrization behind the organ.

Lateroposition is applied to the displacement of the uterus as a whole to one or other side. Slight degrees are frequently congenital and may be considered as within the range of the normal. More marked degrees are due to lateral inflammatory cicatrization or to the pressure of swellings in the opposite half of the pelvis. These remarks also apply to *lateroversión*, the condition in which the long axis of the uterus is deviated to one or other side.

Lateroflexion, *i. e.*, bending of the long axis laterally, is comparatively rarely found.

Elevation of the uterus is usually due to the upward growth of pelvic tumors dragging the uterus upward. Occasionally it may follow adhesions of the fundus to abdominal structures.

In studying displacements the chief attention is usually given to anteversión, anteflexion, retroversión, retroflexion, prolapse, inversion.

(In my arrangement I will consider prolapsus uteri in connection with the injuries of the pelvic floor, see p. 315.)

ANTEVERSION.

This condition is scarcely worth distinct consideration. *Per se* it has absolutely no clinical importance, though for a long time this term has been used to describe a supposed special diseased state of the uterus.

The uterus is enlarged and its long axis more or less straightened, owing

to a diminution of the normal slight ante flexion. The symptoms were formerly attributed to this altered condition of the uterine axis, but such views must now be considered as absolutely untenable.

Anteversion is not a special disease, nor does it produce any special symptoms; it is one of the results of thickening of the uterus, due to a chronic inflammation or subinvolution. (Sometimes even normally the uterus may have very little flexion.) The treatment of anteversion is simply the treatment of metritis. Special anteversion pessaries were used before a correct idea as to the etiology of the condition prevailed. These pessaries were meant to lie in the vagina, and by means of a projecting portion to make pressure through the anterior fornix against the anterior wall of the isthmus uteri, which would thereby become bent over it, and, at the same time, it was believed that the pressure of the corpus uteri would thus be taken off the bladder.

To-day we know that no special influence can be brought to bear on the corpus uteri through the anterior vaginal fornix by such an instrument, and

even if a slight flexion were produced, which is very improbable, the relation of the uterus to the bladder and to the rest of the pelvic floor would remain the same, as far as intra-abdominal pressure is concerned.

Such instrumental treatment must be abandoned, and, as I have already stated, special attention given to the associated changes in the uterus. Sometimes, however, in this condition a pessary may be used to support the uterus for a time in order to relieve congestion, especially where it is much enlarged and tends to sink down, but this support is better obtained by the use of vaginal glycerin tampons, which



Fig. 277.—The so-called anteversion of the uterus.

both help to relieve the congestion, by causing transudation of fluid, and to give the organ some support.

A ring or Hodge pessary may, however, be used, but without any special reference to the so-called anteverted condition of the uterus. Operative interference may be necessary either on account of uterine inflammation or prolapse.

Curetage may often be indicated, and sometimes, also, amputation of the cervix.

When there is considerable prolapse, some procedure for elevating the fundus may be necessary.

ANTEFLEXION.

This term is used to refer to an exaggeration of the normal flexion on the uterus. It is impossible to say what is a really pathologic angle of flexion. Nearly all degrees may be found in conditions of perfect reproductive capability and health. In some cases, however, the most extreme ante flexion

may be a congenital condition, the uterus being often undersized and having a long conic cervix.

Acquired antelexion is mostly due to a posterior or uterosacral cellulitis (parametritis), also sometimes to a posterior perimetritis. Owing to the induration and contraction of the previously inflamed bands, the cervix is drawn backward and somewhat upward, the fundus falling lower. The intra-abdominal pressure now tends to press it continually downward, thereby increasing the anterior flexion on the uterus. Usually in these cases there is more or less inflammation also in the uterine wall, which leads to a fixation of the organ in an extreme degree of antelexion. Endocervicitis is also very common. The point of flexion, which is usually at the isthmus uteri, may, however, sometimes be situated higher up.

This condition is more common in nulliparous than in multiparous women (see "Pelvic Cellulitis").

Symptoms.—In many cases in which there is an abnormal degree of flexion in the uterus there are no symptoms. Here, as in anteversion, we must look to the pathologic accompaniments of the antelexion for the real cause of the distressing symptoms which are sometimes present. These are inflammation in the uterine wall, tubes, or ovaries, or in the peritoneum, or parametric tissue behind

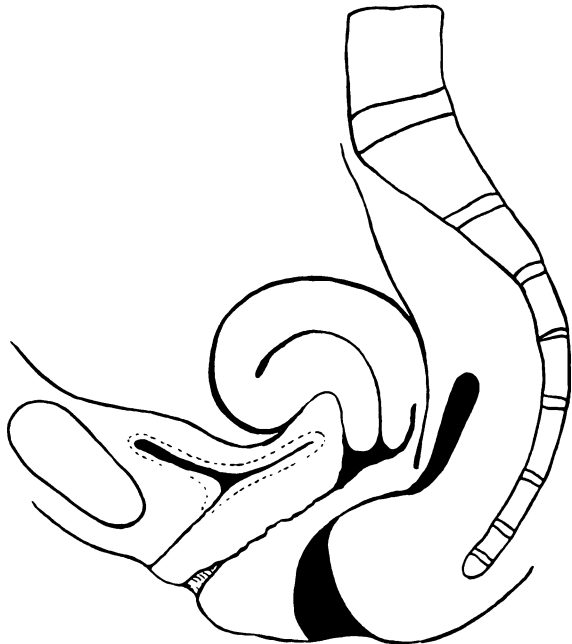


Fig. 278.—Retroposed antelexed uterus.

the cervix uteri; or an associated marked stenosis of the cervical canal. The commoner symptoms in these cases are leukorrhea, sterility, dysmenorrhea, dyspareunia. Menorrhagia, irregular menstruation, or perhaps some degree of amenorrhea may be present; and there may be frequency of micturition or pain on defecation. Pains are often referred to other parts, and neurotic manifestations are common. (An explanation of the causation of dysmenorrhea in these cases is given in the article on "Dysmenorrhea," p. 127.)

Physical Signs.—On bimanual examination the fundus is easily felt through the anterior vaginal fornix, and the angle of flexion can be readily distinguished. The cervix often points downward and forward, and the flexion may be so acute that it is impossible to pass a sound without pulling the cervix down with a volsella, and perhaps even then it may not be possible.

Sometimes, the uterine axis may be straightened between the fingers, but often this cannot be done, owing to the rigidity of the uterine wall; attempts often cause the patient great pain.

The presence of uterosacral cellulitis or posterior perimetritis may be made out best by a finger passed into the rectum.

Differential Diagnosis.—Anteflexion of the uterus must be distinguished from the following: Uterus with small myoma in the anterior wall; cellulitic deposit between cervix and bladder. Ovarian or tubal swelling adherent to the anterior uterine wall; tumor of bladder-wall or vesical calculus.

On bimanual examination a small fibroid of the anterior wall may usually be felt to be distinct from the fundus, except when it is very near to the latter,

when the passage of a uterine sound may sometimes be necessary to determine its position. A cellulitic deposit between bladder and cervix is very rare, and to distinguish it from the fundus uteri the use of the sound may be indispensable.

A tubal or ovarian swelling in front of the uterus usually pushes the latter backward, so that it may be felt by a rectal examination in making a correct diagnosis. However, the use of the uterine sound aids materially. A tumor or calculus of the bladder may usually be outlined on careful

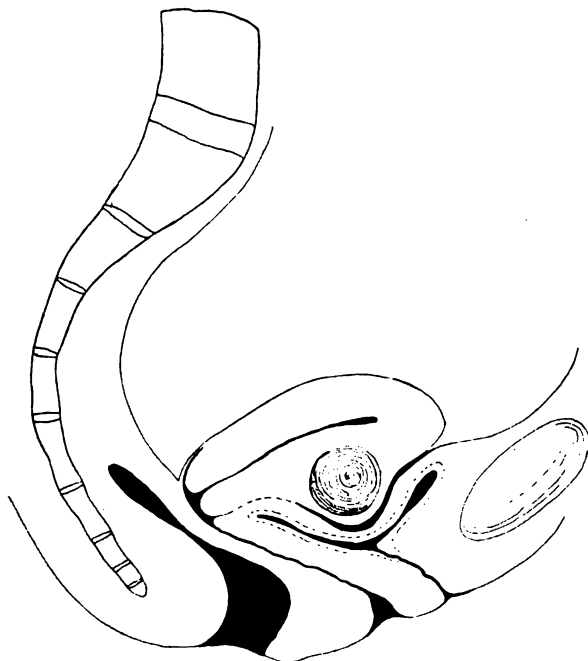


Fig. 279.—Small fibromyoma in anterior uterine wall simulating anteflexion.

bimanual examination with or without the aid of anesthesia, the fundus of the uterus being found above or posterior to it.

Treatment.—The treatment of anteflexion resolves itself into that of the various associated inflammatory conditions. Schultze has pointed out how often these cases improve as the inflammatory products are absorbed, even though the flexion of the uterus still remains at the same angle.

For a long time intra-uterine stem pessaries have been used for the purpose of straightening the uterus. Their use is based upon an erroneous understanding of the pathology; moreover, they are very dangerous because of the injury they cause to the uterine mucosa, thus opening a portal for the introduction of septic infection. All forms of this instrument should be totally abolished, whether simple firm stems like Amann's, soft-rubber stems like Greenhalgh's, or firm stems combined with vaginal pessaries like Beigel's.

In the cases in which the uterus is much enlarged from inflammation, support of the organ for a time by means of vaginal tampons, Hodge or ring pessaries, may be very beneficial, yet their use has, however, nothing whatever to do with the presence or absence of the ante flexion.

Where stenosis of the cervix exists, thorough dilation should be carried out, with or without incision.

E. C. Dudley has recommended a plastic operation on the cervix for the purpose of diminishing the flexion of the uterine axis. Thiriar has introduced an operation termed *cuneohysterectomy*, which is carried out by abdominal section. It consists in removing a wedge-shaped piece of tissue from the convex side of the uterus at the angle of flexion, the raw surface then being closed with sutures; as a result, the degree of flexion is lessened. Such ante flexion operations, in the author's experience, are rarely needed. In cases of ante flexion with prolapse, associated with disturbed bladder function, he has sometimes found it advisable to shorten the round ligaments either by Alexander's method or by an intra-abdominal procedure.

RETROVERSION AND RETROFLEXION.

Retroversion is the condition in which the long axis of the uterus is directed so that the fundus looks toward the sacral hollow. Ordinarily, the long axis remains straight, but occasionally the retroverted organ may retain some degree of ante flexion. Retroflexion, more common than the preceding, is the condition in which the uterus is bent backward on itself so that there is a concavity directed toward the sacrum. As retroflexion is practically found only in a retroverted uterus that has become flexed backward, the two conditions may be considered together.

Etiology.—Temporary retroversion is brought about when the bladder is overdistended.

Permanent backward displacements occur in the following conditions:

1. *Congenital.*—These are occasionally found, retroversion being more common than retroflexion.

2. *Acquired.*—These occur very frequently.

(1) The displacement may develop in the puerperium, its frequent occurrence in this period being due to the increased weight of the uterus causing the fundus uteri to gravitate backward toward the sacrum, especially when the patient lies continuously in the dorsal position and the ligaments are in a lax state. It is also much aggravated if the bladder is allowed to become frequently distended, though usually, however, the con-



Fig. 280.—Retroflexion of uterus on fifteenth day of puerperium.

dition is only a temporary one, the organ assuming the normal anteflexed position as involution proceeds. If, however, a metritis develops during the puerperium, or the patient rises too soon or goes to work too early, a permanent retrodisplacement may be established.

(2) It may also be produced and rendered permanent by posterior adhesions due to peritonitis, puerperal or nonpuerperal; also by—

(3) A small fibroid in the upper part of the posterior wall of the uterus, or any large tumor anterior to the uterus may cause the displacement.

(4) It may sometimes follow cicatrization in the anterior vaginal wall, *e. g.*, in some cases of vesicovaginal fistula.

(5) It may result from a sudden fall or strain.

Certain maldevelopments, *e. g.*, long cervix and short vagina, are believed

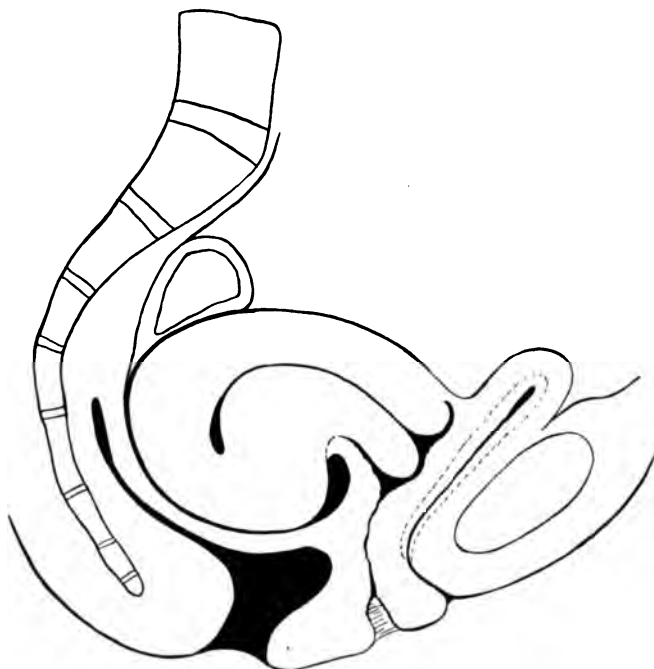


Fig. 281.—Retroflexion of the uterus.

to predispose to the development of these retrodisplacements, so that intra-abdominal pressure is able to bring about the change more easily than under normal conditions, especially if a habitual overfilling of the bladder occurs, combined with an abnormal increase in the intra-abdominal pressure, such as may be found in women who lace tightly, walk, ride, or work excessively.

Retroversion, it must be remembered, is usually one of the early stages of prolapsus uteri.

Anatomic Changes.—*In simple retroversion* the fundus lies in the hollow of the sacrum. The os is directed downward and forward. The cervix presses against the bladder, and may even be close to the pubes if the uterus be much enlarged by metritis.

In *retroflexion* the fundus uteri lies more in the pouch of Douglas, varying in level according to the degree of flexion, and to the extent to which the uterus as a whole is prolapsed. According to many authorities, the posterior uterine wall is somewhat thinned at the angle of flexion, though in a congenital case Ruge found the anterior wall atrophied at this point.

The whole organ is usually congested and more or less enlarged, and if the uterus is at all prolapsed, the cervix may be elongated. The os externum usually looks forward and downward; sometimes, however, directly downward, or even directly forward, so that it may, in some cases, be found close to the pubes.

As a result of these posterior displacements, the ovaries and tubes are dragged down, though often to an unequal extent, yet sometimes they may even lie below the uterus in the pouch of Douglas. The bladder may not be altered in position, but frequently it is somewhat tilted upward or forward. The intestines lie on the bladder and on the anterior surface of the retrodisplaced uterus.

In extreme degrees of retroflexion the ureters may sometimes be twisted so that the free flow of urine along them may be somewhat obstructed; this may lead to changes in the kidneys.

The rectum may be markedly pressed upon, and its function disturbed.

The uterosacral ligaments become stretched; the broad ligaments are bent on themselves and lengthened, while the round ligaments are much elongated and weakened.

Various inflammatory processes may often be found associated with these displacements, *e. g.*, metritis, endometritis, endocervicitis, ovaritis, salpingitis, and pelvic peritonitis, which latter, owing to the formation of adhesions, may cause the displaced uterus to become more or less firmly fixed in its malposition.

Sinclair, of Manchester, points out the very frequent association of erosion and hypertrophy of the posterior cervical lip in cases of chronic posterior displacement. He states that permanent reposition of the uterus is followed by diminution or disappearance of these conditions.

In most cases these inflammations are independent of the displacement and whether the latter condition *per se* intensifies these inflammatory processes is doubted by many. According to others, it may have this influence in a case

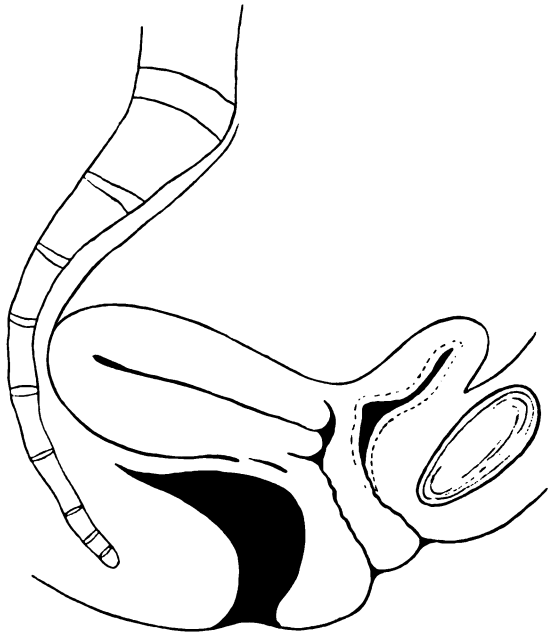


Fig. 282.—Retroverted uterus.

of marked retroflexion, owing to the sluggishness of the uterine circulation, *i. e.*, the passive congestion resulting from the kinking of veins in the broad ligament. The venous network, however, is so rich that it is difficult to understand how a marked obstruction can be caused. Nevertheless, the clinical fact is established that in these posterior displacements profuse menstruation is common; and even though we attribute this phenomenon to the inflammatory changes in the uterus, it must be admitted that they are in some way influenced, especially in the case of a very acute retroflexion. There is no proof, however, that a single posterior displacement, unaccompanied by any inflammation, is necessarily followed by this latter complication, and it is, indeed, hard to understand why this should be so, if we believe that practically all the uterine inflammations are of infective origin. It may, however, be

suggested, though it is not proved, that the retrodisplacements may somehow, by altering the condition of the uterine mucosa, render it more liable to infection by microbial action.

Physical Signs.—

On bimanual examination the retroverted uterine body is to be felt through the posterior vaginal fornix; also per rectum the backward turned corpus may usually be easily palpated. In retroflexion the rounded fundus is felt in the pouch of Douglas, an angle being made out between the body and the cervix; when

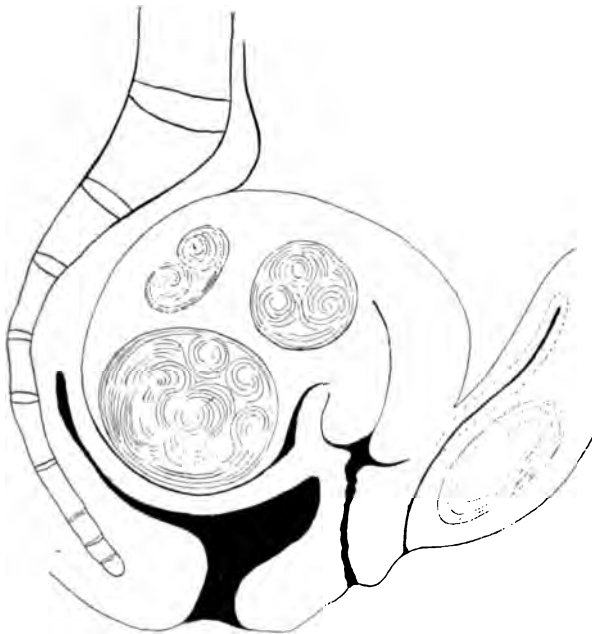


Fig. 283.—Retroflexed fibromyomatous uterus.

one is moved, the other usually moves also, unless there is fixation. In both retrodisplacements the fingers, meeting in front of the cervix, find the uterine body is absent from its normal anterior position. Sometimes it may be necessary to pull down the cervix with a volsella in order to assist in feeling the fundus more certainly. On passing a sound, its concavity is directed toward the back, though it is important to note that this instrument must be used only as a rare confirmatory test, because of the dangers accompanying its use. It is never to be employed to determine the existence of a displacement; this should always be done by bimanual examination.

Students must be very particular not to trust to mere vaginal examination, for the position of the vaginal portion of the cervix is no sure indication of the situation of the corpus uteri; thus in some cases of marked antelexion the

cervix may be directed forward, while sometimes in retroflexion the cervix may be directed downward and slightly backward, so that mistakes between these two opposite positions may be made.

Adhesions are usually diagnosed by finding that the uterus cannot be freely moved by bimanual manipulations. But it must be noted that there often may be restricted movement when there are no actual uterine adhesions. Thus it may be found as the result of adhesions of one or both of the appendages or of stiffening or cicatrization in the broad ligaments. In other cases there may be abundant extensile uterine adhesions which do not interfere much with mobility, *e. g.*, when they are very long or when a loop of freely mobile intestine is attached to the uterus.

Symptoms.—In some cases there are no symptoms whatever. E. Schroeder has reported 188 cases in which they were absent in 25 per cent. Often one or more of the following symptoms may be associated with these posterior displacements: a bearing-down feeling, weakness, or pain in the back; weakness or pain in the lower limbs; constipation with or without rectal tenesmus; frequency or difficulty in micturition; menorrhagia, metrorrhagia, dysmenorrhea, leukorrhea, tendency to abortion, sterility. Reflex and neurotic phenomena are often found, *e. g.*, headache, neuralgias, dyspepsia, etc. In those cases in which considerable blood has been lost, anemia is more or less marked.

There is considerable difference of opinion as to the part played by a backward displacement of the uterus in the causation of symptoms, which are so often found accompanying the condition. Some hold that retroversion *per se* does not produce troublesome symptoms; that normally the uterus is constantly changing its position, according to variations in the condition of bladder and bowel, and that it may frequently, when turned to the back, trouble the woman as little as when turned to the front. They state that the symptoms which are so often found along with retroversion—*e. g.*, pain and weakness in the back, menorrhagia, etc.—are due to the accompanying pathologic conditions, namely, inflammations outside the uterus, inflammations in the uterus itself, subinvolution, or some prolapse of the organ. In favor of these opinions may be mentioned cases in which no symptoms whatever are found.

Other authorities hold that the backward displacement *per se* may cause various symptoms.

I have already referred to the relationship of posterior displacements to the various other pathologic conditions often found associated with them, and it is needless to consider any further the different views which are held on this subject. I would, however, point out that the symptoms mentioned above are those usually caused by the various inflammatory conditions which are found in the pelvis, and that, while it may be admitted that the influence of retrodisplacements *per se* in causing symptoms has been exaggerated, it is equally certain also that the great majority of women in whom the displacements are found usually complain of one or more of the symptoms which have been mentioned.

Differential Diagnosis.—The following conditions must be diagnosed from retroversion and retroflexion.

1. Mass of feces in the rectum.

2. Uterosacral or perirectal cellulitis.
3. Exudates in the pouch of Douglas, *e. g.*, hemocele; peritonitis.
4. Prolapsed and enlarged ovary or tube.
5. Myoma of the posterior uterine wall.
6. Retroposition.

A fecal mass in the rectum pressing forward against the uterus may be mistaken for the fundus of the uterus on vaginal examination. The fecal matter is doughy and pits on pressure; it may be confirmatory to introduce a finger into the rectum. This, combined with careful bimanual manipulations, clears away all uncertainty, though in every case where practicable the use of a cathartic preceding the examination should be employed.

The thickening of a uterosacral cellulitis may also be mistaken on vaginal

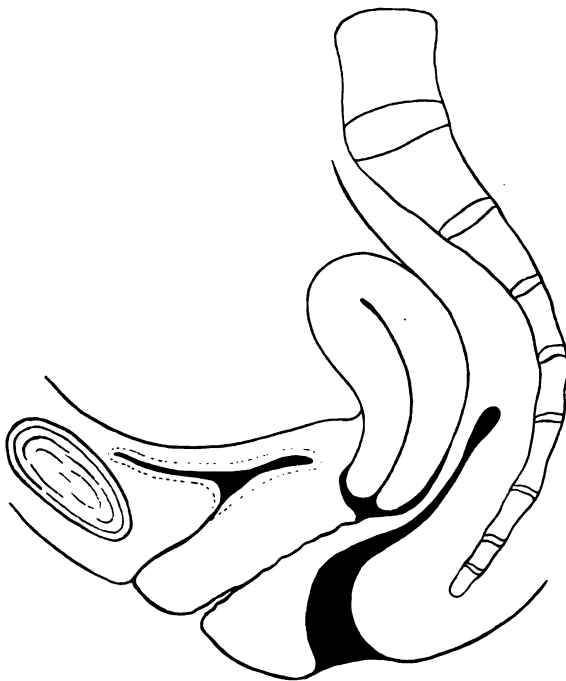


Fig. 284.—Marked retroposition of the uterus.

examination, but on rectal examination the finger usually easily establishes the site and character of this posterior thickening. Swellings due to inflammation, hemorrhage, or new-growth in the pelvic cavity or in the cellular tissue posteriorly may simulate the body of the uterus, and sometimes the latter cannot be determined either bimanually or rectally even under anesthesia. In such cases the sound may be necessary to determine the position of the fundus.

Similarly, ovarian or tubal swellings in the pouch of Douglas may so closely simulate the uterine body that the

most careful bimanual examination may fail, and anesthesia be necessary, or even, indeed, sometimes the introduction of the uterine sound. It should always be borne in mind that pressure of an ovary causes a peculiar sensation of tenderness which is most highly marked in conditions of inflammation.

A fibroid of the posterior uterine wall is frequently mistaken for the body. Careful bimanual examination may establish the diagnosis, especially when the tumor is small and localized. When it is of some size and merges into the fundus, it may be more difficult to distinguish. The uterine sound may sometimes aid in the diagnosis, though even this may fail.

Retroposition may easily be mistaken for a retroversion when a vaginal alone, or a carelessly performed bimanual, examination is made. In the

former condition the cervix is usually also directed forward, but, as a whole, lies more posteriorly than the latter. The exact nature of the case is better established by a careful abdominorectal bimanual examination.

Treatment.—In considering cases of retroversion from the viewpoint of treatment, the most careful consideration must be given to all circumstances connected with them. In recent years, both in Europe and America, the older methods of conservative treatment have been widely displaced by the radical operative procedures. Among American women the latter have undoubtedly grown in favor, because of the reduction in the operative mortality and because they prefer a plan which may be quickly carried out and which offers good chances of permanent relief compared to one which involves many months or even years of "doctoring" with little hope of lasting results.

While the author's experience inclines him to favor strongly the radical methods of cure, he desires to describe all the other procedures which may be employed to treat these displacements.

The following varieties must be considered:

1. Retroversion accompanied with fixation by means of peritonitic adhesions.

In such cases the uterus cannot be replaced, *i. e.*, turned to the front. Pessary treatment is of no avail. The case may be treated by douches, baths, glycerin tampons to reduce inflammation or soften adhesions. Stretching of adhesions by means of massage or by means of vaginal dilators—*e. g.*, Bozeman's—is recommended by some. These methods are usually unsatisfactory, and operative treatment is indicated if troublesome symptoms exist.

2. Retroversion of a freely movable uterus, not enlarged, and unaccompanied by any pelvic or reflex symptoms. In such a case there may be no necessity for changing the position, especially if the woman be at the menopause or has passed it, or if she be unmarried. When, however, women with such a condition are subjected to increased intra-abdominal pressure, from heavy lifting, vigorous exercises, or chronic cough, or are likely to become pregnant, it is advisable to antevert the uterus and to use a pessary for the purpose of keeping it in its proper position; for, undoubtedly, the uterus may, when retroverted, show a greater tendency toward prolapse under the influence of increased intra-abdominal pressure than when it is anteverted. In these cases the Hodge or Albert Smith pessary does well. Occasionally after a pessary has been worn for some months the uterus may not return to its displaced position after removal of the instrument. An alternative plan of treatment is, however, preferred by many, *viz.*, radical operative measures.

3. Retroversion of the freely movable puerperal uterus, unaccompanied by pelvic troubles.

It is now recognized that normally, in many women, during the involution of the uterus in the early weeks after labor, the uterus may be turned backward. In many of these cases, undoubtedly, the uterus will return unaided to its normal position. Yet this does not always happen, and in many cases the condition, if neglected, may become permanent, especially in women who have had several children, whose health is poor, and who engage in vigorous exercise or hard work—factors which cause increased intra-abdominal pressure and stretching of the uterine supports. Physicians should, therefore, examine

their puerperal patients several times, during the weeks following their leaving the lying-in room. If, at the end of a month, the uterus is still retroverted, it is advisable to replace the organ and to introduce a suitable Hodge or Albert Smith pessary for a few weeks or months.

4. Retroversion of the movable pregnant uterus in the early months. In every case the uterus should be anteverted, and a Hodge or Albert Smith pessary worn until the pregnancy has well entered the fourth month, *i. e.*, until all danger of an incarceration in the pelvis is past.

5. Retroversion of a movable uterus, where pelvic symptoms are present, but where the ovaries are not prolapsed into the pouch of Douglas, nor any special tenderness exists in the perimetric or parametric tissues.

In such a case the uterus should be replaced anteriorly and a Hodge or Albert Smith pessary introduced. As an alternative, operative measures may be adopted.

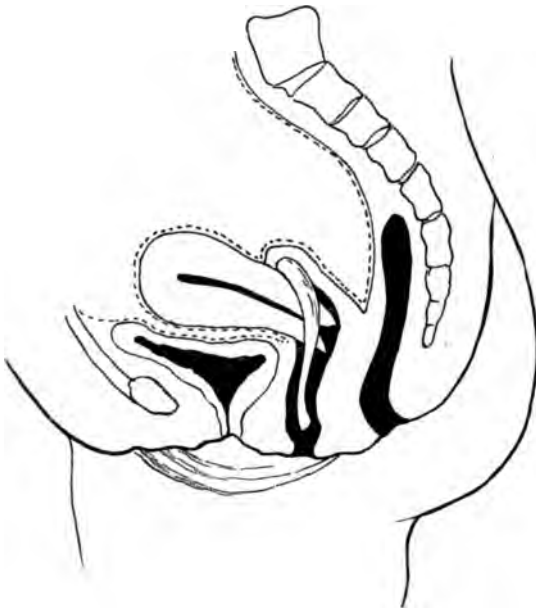


Fig. 285.—Vaginal pessary in position.

6. Retroversion of a movable uterus where pelvic symptoms are present, and where one or both of the ovaries are prolapsed into the pouch of Douglas. These are generally very troublesome cases to deal with. If the ovaries be inflamed as well as prolapsed, pessaries should not be used until after the glycerin tampons and the vaginal douche have been resorted to sufficiently long to reduce all inflammation; and even after this is accomplished and the uterus is replaced, it is often a matter of

difficulty to select a suitable instrument. In a certain number of cases, owing to the sensitiveness of the ovaries, no form of pessary can be endured, while in other cases a Hodge or Albert Smith pessary acts well and causes no pain even though the ovaries still remain prolapsed. A Thomas pessary with a thick rubber upper end may often be found more suitable than the entirely hard instruments, or a soft-rubber ring pessary may be borne with comfort when no hard instrument can be tolerated. In all cases where the ovaries are noticeably tender or inflamed, it is best, after the use of the douche and tampons, to use a soft ring pessary for a time, at least, before trying one of the hard variety, even though the ring may not keep the uterus to the front, but merely act as a general support to it, thereby having a beneficial influence in allowing the congestion of the uterus to be relieved.

In some cases of prolapse of only one ovary benefit may sometimes be

obtained from the use of a hard instrument, in which the upper angle on one side is absent to insure nonpressure on the ovary while the pessary is in position. In the great majority of cases, however, conservative treatment on these lines is very unsatisfactory, and operative interference should be strongly urged.

7. Retroversion of a movable uterus, accompanied by pelvic symptoms, where old posterior perimetritis or some remains of cellulitis are present.

These cases are also very troublesome. The conservative line of treatment is the same as that laid down in the last section, but it does not compare with the operative measures in giving satisfaction.

Retroflexion of the Uterus.—All that has been said regarding the treatment of retroversion may be stated with regard to retroflexion. Practically, wherever retroflexion exists retroversion is present, and the employment of pessaries like Hodge's and Albert Smith's after the replacement of the uterus is related primarily to the posterior version, not to the flexion. Disappearance of the flexion depends on the consistency of the uterus and its relation to the intra-abdominal pressure.

Methods of Replacing the Displaced Uterus.—1. *By Bimanual Manipulations.*—Occasionally in thin women with a lax abdominal wall the fundus of the uterus may be turned to the front by abdominovaginal manipulations. The patient is placed in the lithotomy position, the bladder and rectum having been previously emptied. The vaginal fingers are pressed high in the posterior fornix, so as to elevate the uterine body lying in the pouch of Douglas. The fingers of the other hand resting on the abdominal wall are pressed downward toward the posterior part of the pelvic inlet, so as to carry the fundus forward.

If abdominorectovaginal manipulations are made, replacement may be more satisfactorily carried out, for the middle finger in the rectum is made to pass higher than the vaginal finger, and so is more efficacious. The vaginal finger (forefinger) is best employed in pushing the cervix toward the back. In some cases this method may not be successful at first, but only after one or more trials. In otherwise difficult cases general anesthesia may often permit of easy replacement by this method.

2. *By Manipulations in the Genupectoral Posture.*—A more satisfactory method, and one which is applicable to a larger percentage of cases than that above described, is the employment of manipulations in the genupectoral posture. After previous evacuation of the rectum and bladder, the patient, whose clothes have been loosened at the waist, is placed in this position and the vagina opened to allow air to enter. The displaced uterus, which tended to fall toward the sacrum, may, if the cervix be tilted toward the sacrum by a finger passed into the vagina, cause the fundus to pass downward and forward to the front. In some cases it is necessary to use rectovaginal manipulations to cause the fundus to leave the sacrum. (Sometimes it is advantageous to pull down the cervix with a volsella.) The vaginal or rectovaginal finger being kept in position, the patient is now made to turn completely around, so as to lie in the lithotomy position. The other hand is then placed on the abdomen, in order to manipulate the fundus of the uterus forward.

3. *With the Sound.*—Formerly another method of replacing the uterus was widely employed, viz., the rotation of a sound introduced into the uterine cavity. Such a procedure employed as

a routine practice, without due regard to strict aseptic technic, must be considered as unwarrantable, because of the risk of introducing infection. The uterine mucosa may easily be lacerated or even the wall perforated.

No attempts to replace the uterus should be made if adhesions or inflammatory or other swellings are present in the pelvis. Little force is necessary, as a rule.

The recommendation of Schultze and others that in cases of adhesions the latter should be forcibly torn by bimanual manipulations under anesthesia is to be strongly condemned, on account of the great risk of causing internal hemorrhage, injuring the bowel, tubes, or other structures; sometimes, indeed, releasing encapsulated septic material with resultant peritonitis.

Operative Measures.—Within recent years much ingenuity has been



Fig. 286.—Author's round-ligament operation. The method of drawing the round ligament through the broad ligament is shown.

displayed in devising operations for the purpose of keeping the uterus permanently in its normal position, *i. e.*, with the fundus anterior.

Comparatively few of these have found permanent favor with operators. Some have been abandoned because of their worthlessness, others because they have introduced conditions which are calculated to be a source of danger in the event of the occurrence of pregnancy. In the author's experience the procedure which has given the best satisfaction and which is applicable to the greatest number of cases is one which was first described by him in the "Journal of the American Medical Association," October 5, 1901.

I. Internal Shortening of the Round Ligaments by Stitching them to the Posterior Wall of the Uterus.—Ordinarily, it is advisable to carry out preliminary curetage. If the cervix is much hypertrophied and contains many

Nabothian cysts, a portion should be amputated. In view of the recent researches of Sinclair, of Manchester, amputation ought to be carefully restricted. He has shown that cervical hypertrophy and erosion of the posterior lip usually disappear after reposition of the displaced uterus.

(a) *By the Abdominal Route.*—The abdomen is opened while the patient is in the Trendelenburg position. Any operative procedures for pathologic conditions that may exist along with the displacement are first carried out. The fundus uteri is then raised toward the abdominal incision and is held toward the pubes by a tenaculum forceps.

An ordinary long forceps is then placed against the broad ligament on one side close to the uterus, immediately under the utero-ovarian ligament, and is pushed forward through the ligament, emerging just above the round ligament. The latter is grasped and pulled back through the broad ligament, so as to lie doubled on the back of the uterus. The surface of the latter is scratched with



Fig. 287.—Author's round-ligament operation. The round ligaments are represented as they appear when stretched to the posterior surface of the uterus.

the point of a knife adjacent to the attachment of the utero-ovarian ligament. The round ligament is then spread over this area and attached to it with a collodion linen suture, the smooth peritoneal surface of the flattened ligament remaining superficial. One or two sutures may also be used to attach the round ligament to the edge of the perforation in the broad ligament. The other round ligament is then similarly dealt with. As a result of this procedure, the uterine body is practically slung between the round ligaments shortened by their partial transplantation to the back of the organ.

When the operation is accompanied by removal of the tube and ovary on one side, the broad ligament may be divided somewhat vertically and the round ligament doubled back over the former, so that it may be stitched to the posterior surface of the uterus as already described. If bilateral removal of the appendages be carried out, this method is employed on both sides, perforation of the broad ligaments being, therefore, unnecessary. Great care

should be given to the covering of all raw surfaces following the removal of diseased parts. The author does not recommend this method in those cases in which the outer portions of the round ligaments are noticeably thinned. In such conditions he prefers to draw the ligaments outward in the abdominal wall, stitching them to the anterior surface of the aponeurosis covering the recti muscles. The procedure is very simple. After the interior of the pelvis has been examined and pathologic conditions treated (through the ordinary mesial incision), the skin is pushed aside from the aponeurosis at the lower part of the incision and a curved forceps is passed outward in front of the aponeurosis toward the internal ring, where it is made to penetrate the peritoneum. The round ligament is grasped and pulled outward, being arranged so that the uterus is placed most satisfactorily. Each ligament is stitched to the outer surface of the aponeurosis with fine linen thread. The abdomen is then closed. In all cases in which plastic work on the vagina or perineum has not been previously carried out, a Hodge or Albert Smith pessary should be placed in the vagina before the patient leaves her bed, and should be worn for two or three months. In this way support is given to the uterus while the newly formed attachments of the ligaments are becoming firm. In the case of virgins, however, with a small *introitus vaginae*, it is not advisable to use the pessary. I have had perfectly satisfactory results in cases in which the instrument has not been used, but I believe that its employment will reduce to a minimum the chance of a relapse. It is not impossible that a sudden strain or fall or overdilatation of the bladder might be followed by separation of the new attachments of the round ligaments.

It is advisable that pregnancy should not take place until a year has elapsed after this operation.

(b) *By the Vaginal Route.*—I have performed this operation through the vagina only in a very small percentage of cases. It is more difficult than the abdominal method.

It should not be employed if important intrapelvic pathologic conditions exist in addition to the displacement which require attention. Nor should it be attempted if the vagina be not roomy enough to allow the fundus of the uterus to be easily pulled down through an anterior colpotomy incision. The latter should be that illustrated in Fig. 124. When the round ligaments are not much elongated, they cannot be effectively doubled through the broad ligament. When this difficulty exists, it is best to adopt another procedure. Each round ligament should be tied close to the uterus and then divided external to the catgut. Each broad ligament is then perforated, and the ends of the round ligaments drawn through and stitched to the upper part of the posterior surface of the uterus. The latter is then carefully pushed upward into its proper position in the pelvis and the vaginal incision closed.

Alexander's Operation.—In 1881 Alexander, of Liverpool, first performed the operation of shortening the round ligaments by cutting down over each external inguinal ring, pulling the ligaments out as far as possible and stitching them so that they could not again retract inward. This procedure had been suggested in 1840 by Alquiè, of Montpellier, but had not been performed by him on the living subject.

The operation has been widely practised, and has met with much commendation in many quarters. By many operators it has been abandoned to a great extent, being employed only in a few selected cases.

Limitations of this Operation.—The indiscriminate use of this operation is certain to be followed by some very unsatisfactory results. Cases must be most carefully selected. Those in which intrapelvic pathologic conditions exist, *e. g.*, tubal or ovarian disease, adhesions, etc., are not at all suitable for the operation, for in a very large majority of cases the patient's symptoms are caused by these complications rather than by the uterine displacement. It is, therefore, more rational in such cases to perform an intra-abdominal operation, so that all pathologic conditions may be studied and corrected as far as possible. Alexander himself rightly points out that the most suitable cases are those in which the displacement is uncomplicated by any other lesion, but his opinion that the operation may also be performed when other complications exist, in the hope that there may be some improvement, is not one which will be sustained by the majority of gynecologists. In the early days of the Alexander procedure it was largely favored because it had a smaller mortality than those operations which involved opening the peritoneal cavity, but at the present time this advantage can scarcely be urged, for the latter in the hands of careful operators with our improved technic is quite as safe.

The difficulty of determining the *exact* condition of the pelvis by examination even under anesthesia is sometimes considerable. The most expert gynecologists not infrequently find, on opening the abdomen, conditions which they failed to recognize in their previous physical examination. This is particularly so with regard to adhesions. I have several times observed cases in which a movable retroverted uterus without complications was believed to exist, the abdominal incision revealing utero-intestinal adhesions. Very frequently adhesions of tubes or ovaries are not diagnosed. Tubal accumulations of fluid are easily missed, even when the quantity is considerable, though not sufficient to cause tenseness of the sac-wall.

Technic.—As performed by Alexander at the present time, the various stages are as follows: The patient, after being anesthetized, is placed in the lithotomy posture in order that the displaced uterus be moved to its proper position by bimanual manipulations. A Hodge pessary is then placed in the vagina if the case be one of simple retroversion; if there be retroflexion as well, a stem pessary is as well introduced into the uterus. He states that the former instrument, by pushing up the retro-uterine tissues, allows the uterosacral ligaments to recover their tonicity and gradually shorten. The stem pessary is meant to straighten the uterus in order to prevent the possibility of elevation with the retention of any posterior flexion. The patient is then placed in the dorsal position. The operator makes an incision on one side, an inch or more in length, from the pubic spine outward in the line of Poupart's ligament. The tendon of the external oblique muscle is reached, and the external inguinal ring exposed. A few fibers of the intercolumnar fascia are divided, when the contents of the canal usually bulge out, and the round ligament with its nerve and vessels are noted turning obliquely over the lower pillar. The nerve is divided, and the ligament is seized with dissecting forceps and drawn outward until it can be held with thumb and finger. It is then pulled out as far as possible—usually three or four inches; as the tension is increased, the color of the ligament changes from pink to a paler hue.

A single silkworm-gut suture is then passed through the skin of one side, through the pillar of the ring of the same side, then through the center of the ligament at its point of emergence and the pillar of the ring and skin on the opposite side of the wound to that in which the needle was introduced. The suture is tied firmly; all retractors are then removed from the wound and the suture tied firmly. The other end of the ligament is cut off, the stump being ligated if necessary. The rest of the wound is then closed.

A similar procedure is then carried out on the other side.

C o m p l i c a t i o n s .—Sometimes the cord cannot be drawn out, owing to adhesions in the inguinal canal or in the peritoneal cavity. Occasionally the cord is poorly developed or atrophied, and may be broken by careless manipulations, especially if the mistake be made of pulling it with forceps. When such an accident occurs; it may be necessary to open the inguinal canal in order to recover the upper end of the ligament. Absence of the cord has been reported in a few cases; it is doubtful, however, if these reports are entirely correct, for a thin cord may easily be broken by careless dissecting so as not to be recognizable. In a very small percentage of cases the canal of Nuck is patent from the internal ring to the pubes, the round ligament being embedded in the wall of the passage, so that it cannot be easily separated and shortened. (Sometimes an inguinal hernia exists, the round ligament being found on the hernial sac. It must be carefully dissected from the latter, and both the radical operation for hernia and shortening of the ligament may be done at the same time.) At the end of the second week the silkworm-gut sutures are removed. If a stem pessary has been placed in the uterus, it is removed at the end of three weeks, when the patient leaves her bed. The vaginal pessary is not removed until two months or more have elapsed.

V a r i a t i o n s .—The operation has been variously modified by different operators, both as regards the nature of the incision, the method of dealing with the ligament and also of introducing sutures. Thus, some expose the whole inguinal canal; others do not cut off the part of the ligament but stitch it in a new position. Buried catgut is a favorite suture with many. Particular reference need be made only to the plan suggested by Goldspohn, viz., in every case to open the abdomen through each internal ring in order to inspect the pelvis and to carry out, if necessary, any intrapelvic procedures, but such suggestions are not to be commended when it is possible to accomplish the same results through a single median incision. Alexander has advised that when adhesions exist which are likely to interfere with the success of his operation, they should be broken forcibly under anesthesia as a preliminary measure. Such advice should not be followed, as it is not scientifically justifiable to employ such rough and blindly uncertain measures when the median abdominal incision offers the opportunity, by a free exposure of the internal pathologic conditions present, a chance of their removal in such a manner as not to leave fresh raw surfaces.

In cases in which plastic work is carried out either in the vagina or on the perineum at the time of the ligament operation, it is not advisable to place a pessary in the vagina during the healing period.

Other Methods of Shortening the Round Ligaments.—Mann has advocated folding each ligament on itself in front of the uterus, so that three thicknesses

are made to extend from the parietes to the uterus, the folds being carefully stitched together, preferably with unabsorbable sutures. The operation is carried out through an abdominal incision. Goffe recommends a somewhat similar procedure carried out through a vaginal incision. Palmer Dudley folds the ligaments anteriorly and sutures the end of the loop to the anterior surface of the uterus. Byford folds the ligaments anteriorly and stitches the loop to the abdominal parietes, opposite or behind and a little above the internal inguinal ring.

Baldy prefers a method somewhat similar to my own procedure, already described, only instead of doubling the round ligaments through the broad ligaments, he cuts them from the uterus and draws them through, stitching them to the back of the uterus. As already stated, I have found it advisable to employ this method only when operating through the vaginal incision, whereas Baldy uses it in the abdominal operation. Other operators have advised that the round ligaments be doubled and stitched to the anterior surface of the uterus. Others split a portion of each ligament in its long axis, folding each half transversely and stitching the raw surfaces together. Barrett, after operating through a median incision, draws each round ligament through an opening in the peritoneum at the internal ring, and stitches it to the under surface of the aponeurosis in front of the rectus muscle.

C. H. Mayo's operation is very similar.

Operative Procedures Resulting in the Attachment of the Uterine Body to the Anterior Abdominal Wall above the Pubes.—In recent years the attachment of the fundus uteri to the anterior abdominal wall has been very much in favor as a means of treating retrodisplacements. Though a few operators have endeavored to effect this by means of the vaginal route, the majority have employed the median abdominal incision. As the latter is by far the most satisfactory, being applicable to all cases, it alone will be considered. In the operation it is necessary to distinguish between those cases in which the attachment of the uterus results in a permanent close union between the fundus and the abdominal wall and those in which the fundus remains connected by means of a fibrous band. The former procedure is termed ventral fixation, and the latter ventral suspension. These terms are frequently used synonymously, an error which should be carefully avoided; for while the operations are very similar, their after-effects may differ markedly.

Ventral Suspension.—This operation has for its aim the establishment of a fibrous band between the fundus of the uterus and the anterior abdominal wall. It has been made widely popular in recent years, chiefly owing to the influence of Howard Kelly, whose method has been adopted by many operators.

T e c h n i c.—The abdomen is opened by the usual mesial incision. If various pathologic conditions exist, they are attended to, and the fundus uteri is then carried forward and held by a tenaculum forceps. A ligature is then introduced through the parietal peritoneum, about three-eighths of an inch from the edge of the incision, and about three-quarters of an inch above the pubes; it is then carried through a small portion of the posterior uterine wall immediately behind the fundus, and again through the parietal peritoneum of the opposite side. Another ligature is introduced in the same manner a

quarter of an inch nearer the umbilicus. They are then tied, the knots remaining within the edges of the parietal incision.

Variations.—The level above the pubes at which the uterus is attached varies slightly in the hands of different operators. Some pass the sutures through the actual fundus, others through the anterior wall just below the fundus. Various suture materials are employed, viz., absorbable and non-absorbable. I have used both varieties and have found that a stronger suspension-band is formed when the latter are employed. Some operators pass the sutures which hold the uterus through the whole thickness of the abdominal wall.



Fig. 288.—Diagram illustrating the band which attaches the uterus to the abdominal wall after ventrosuspension.

Results.—For a time after the operation the fundus remains close to the abdominal wall. Gradually in the course of a few months it recedes from it, the peritoneum being elongated in the form of a band. Sometimes, however, the peritoneum may not be pulled down, but only a stretching of adhesions is brought about. The band thus formed acts as a suspensory ligament of the fundus; it varies in thickness and strength in different cases, and, consequently in the extent of the elongation by stretching. This latter is affected by other factors, viz., the weight of the uterus, a tendency to prolapsus uteri, the amount of bladder distention which may occur

from time to time, the extent of work and exercise and consequent increase of intra-abdominal pressure to which the patient subjects herself during the year following operation.

In some cases the suspensory ligament is so fragile that it may be completely severed, the uterus returning to its former displaced position. More frequently, however, the ligament stretches, allowing the uterus to sink gradually backward. In two cases in which I opened the abdomen more than eighteen months after ventral suspension had been performed I found the uterus again retroverted, the suspensory ligament being, in each instance,

nearly five inches in length. I have also several times opened the abdomen in cases in which a previous ventral suspension had produced satisfactory results, the length of the ligament varying from one to two inches. The effect of pregnancy in women on whom the operation has been performed is always to either tear or greatly stretch the suspensory ligament, so that after involution has occurred it is no longer of any use. Recurrence of the uterine



Fig. 289. —Uterus with suspensory band attached. Ventrosuspension had been carried out two years previously. The uterus had again become retroverted.

displacement may, therefore, be frequently expected under such circumstances unless other measures are taken to prevent it. The operation should rarely cause abortion or an abnormal irregular development of the pregnant uterus. When such a complication occurs, if no other cause is evident, it may be suspected that the operation has resulted in *ventral fixation* rather than ventral suspension. The establishment of a suspensory band has been criticized by many on the ground that it might lead to intestinal strangulation.

While such a possibility must be admitted, it appears that, as yet, very few reports of this calamity have been published, so that it cannot be regarded as a very serious objection to the operation.

There can be no doubt, however, that it is not best to make such a band if equally good results can be obtained in any other manner; further, also, if the band is liable to stretch so as to become useless or even tear, an effort should be made to operate by a more satisfactory procedure, and it is for this reason that within the last two years the author has gradually abandoned the operation of ventral suspension, replacing it by the method already described, viz., that in which the round ligaments are doubled through the broad ligaments and stitched to the back of the uterus.

A f t e r - t r e a t m e n t.—The treatment is the same as for abdominal section cases in general. Marked distention of the bladder should not be allowed. The patient should be made to urinate every four or five hours, the catheter being used only when necessary. A Hodge or Albert Smith pessary should be placed in the vagina at the time of operation unless plastic work has been carried out on the vagina or perineum and should be left in position for two or three months. When the patient is able to walk, she should take only light exercise and should not attempt heavy work until after seven or eight months.

Other Methods of Performing Ventral Suspension.—Olshausen has recommended stitching of the round ligaments to the abdominal wall as follows: After the abdomen is opened and the uterus elevated, three catgut sutures are introduced on each side through the round ligament, peritoneum, transversalis fascia, and part of the rectus abdominis muscle, at intervals of about half an inch, the uppermost being placed near the uterus. A great objection to this method is that, as adhesions form and stretch, allowing the uterus to sink somewhat, an opening exists above the fundus uteri in which intestines might become strangulated. Also openings might be left between the sutures attaching the round ligaments to the abdominal wall.

Carl Beck makes use of one round ligament, separating it from the broad ligament near the uterus and drawing a loop through the abdominal incision. The peritoneum is closed behind the loop and in a second layer the aponeurosis of the external oblique supports the loop at both ends. This operation results in the formation of a fairly good suspensory band, but the uterus hangs asymmetrically. A. H. Ferguson recommends dividing each round ligament about an inch from the uterus, and drawing the uterine portion through an opening made in the peritoneum and transversalis fascia lateral to the mesial incision, where it is stitched with catgut. This procedure forms an opening between the fundus uteri and the abdominal wall. If the ligaments remain in the position in which they are stitched, the restriction in the movement of the fundus might possibly produce abnormality in the progress of pregnancy should the latter occur, though, undoubtedly, the ligaments may stretch sufficiently to allow the pregnancy to continue normally.

Franklin Martin has recently described his procedure as follows:

“When the repair work is accomplished and the uterus freed from adhesions, a strip of peritoneum, one-third of an inch wide, is severed with scissors from one side of the wound; the upper end of the strip is severed from its peritoneal attachment, thus leaving a ribbon of peritoneum the

length of the peritoneal incision attached at its lower end beneath the lower angle of the wound above the bladder.

"The uterus is now brought forward; a flat Cleveland ligature carrier is passed from behind forward just back of the crest of the uterus beneath its peritoneal covering for a distance of half an inch, and as the ligature carrier emerges at the crest of the uterus, it is made to grasp the end of the ribbon of peritoneum, and as it is withdrawn the strip of peritoneum is drawn through beneath the half-inch isthmus of peritoneum on the fundus of the uterus.

"The upper free end of the ribbon of peritoneum is now grasped with the forceps and the uterus is slid well down on it until the fundus lies well forward beneath the lower angle of the wound. A supporting catgut suture is passed through the peritoneal coat of the uterus at a point back of that occupied by the new peritoneal ligament (far enough away from it to avoid constricting it), and the uterus is temporarily suspended by this by passing the two free ends through the peritoneum and deep fascia on either side of the wound and tying it.

"The upper free end of the strip of peritoneum is secured by including it in the running catgut suture which closed the peritoneum. This reunites it to the peritoneum, from which it was severed, and the balance of the wound is closed with layer sutures.

"If this procedure is carried out carefully, it makes an immediate suspension by the peritoneum. As the strip of parietal peritoneum is threaded beneath an isthmus of uterine peritoneum and both have abundant blood-supply from their original attachments, and as peritoneum is applied to peritoneum at the point of union, everything is favorable for an immediate union. In the mean time the uterus is maintained in position provisionally during the life of the suture material by the catgut suture."

Ventral Fixation.—This operation has for its aim the firm attachment of the fundus uteri to the abdominal wall, so that it shall always remain in this position. It is rarely necessary and should never be performed in a woman still capable of becoming pregnant, because it is certain to cause dangerous complications if pregnancy should occur. In retroversion cases I have occasionally employed it, viz., when the uterus was considerably enlarged and prolapsed, when both ovaries or both tubes were removed on account of disease, and when there was more or less general enteroptosis. I have also performed it after the menopause in cases of a marked prolapsus uteri, extensive plastic repair of the pelvic floor being at the same time carried out.

T e c h n i c.—The fundus uteri is drawn into the lower end of the abdominal incision and scratched with a knife in several places. It is held with a bullet forceps while the edges of the peritoneum are stitched to it, about half an inch apart. The rest of the peritoneal incision is then closed. Catgut may then be used to approximate the fascia, muscle, and fundus, or if through-and-through nonabsorbable stitches are passed through skin, fascia, and muscle in order to close the wall, one of these may be passed through the fundus.

Vaginal Fixation.—Various methods of fixing the uterus through a vaginal incision have been introduced, but need not be fully described. The operation is one which has not met with general favor, having, indeed, in recent times

been widely abandoned. It should never be performed in women who are still capable of becoming pregnant, because of the interference with normal gestation or labor which is likely to follow. Such a procedure as that advocated by Vineberg, viz., shortening of the round ligaments in addition to vaginal fixation, is apt still further to increase the risk in case pregnancy occurs. Irritability of the bladder is a distressing condition which not infrequently follows vaginal fixation. Kölscher states that suspension and fixation seem to affect the function of the bladder. The operations may be followed by frequency of urination. He thinks there is a lessened resistance in the bladder mucosa to infection.

It is sufficient to describe the following method of performing the operation:

The patient is placed in the lithotomy position. The cervix is drawn down and the anterior vaginal wall is divided mesially in its upper three-fourths. The base of the bladder is separated both from it and from the cervix. The peritoneal fold from the bladder to the uterus is stripped upward as high as possible, the cervix being pulled downward with a volsella. The cervix is then pushed well back and catgut sutures (No. 3) passed through the edge of the vaginal incision, the cellular tissue between cervix and bladder, and the surface of the uterus below the peritoneum. The remaining ununited edges of the vaginal wound are then closed with continuous catgut.

Several operators, *e. g.*, Werth, have introduced procedures for the purpose of fixing the uterus to the bladder through a vaginal incision. They need not be noticed, because they are in general unsatisfactory and unnecessary, and, in women who may become pregnant, absolutely unjustifiable.

Posterior Traction on the Cervix.—Various plans have been devised of shortening the uterosacral ligaments in order that the cervix might be drawn more toward the back of the pelvis. Such a procedure, if successful, is an important feature in the operative treatment of marked retroversion. The author employs it as an accessory to a round-ligament operation performed by the abdominal route whenever the uterosacral ligaments are very much relaxed, allowing the cervix to hang near the pubes. In cases in which they are only moderately stretched, they need not be shortened, because they tend to retract after the replacement of the uterus, sometimes to a considerable extent.

The method employed by me in shortening the ligaments is simple. Each one is folded on itself by a continuous linen suture until the desired amount of shortening is obtained.

Byford, Bovée, Sängér, Goffe, and others have devised procedures for shortening the uterosacral ligaments by the vaginal route. Bovée performs the operation without opening the peritoneum, the ligaments being exposed and shortened with kangaroo tendon. Various attempts have also been made to stitch the posterior wall of the cervix to the posterior vaginal wall. Amusat, in 1850, cauterized the posterior fornix so as to obliterate it.

Pryor has introduced an operation which has for its aim the opening of the pouch of Douglas per vaginam, and the introduction of gauze for the purpose of producing an exudate in which organization may take place, leading to contraction which may draw the cervix posteriorly.

These vaginal procedures have never been widely practised. Thus Bovée, in 1902, was able to collect only 92 reported cases in which shortening

of the uterosacral ligaments had been carried out, the majority of which had been performed by the vaginal route.

INVERSION OF THE UTERUS.

This is the condition in which the uterine body is turned in upon itself, the inverting portion extending downward toward or through the cervix.

Etiology.—Inversion occurs under two conditions:

1. In the puerperium.

2. Associated with the growth of a tumor in the uterine wall.

1. *Puerperal Inversion.*—The condition is most frequently produced during the third stage of labor; in some cases, within a few hours of labor; rarely, at a later period in the puerperium.

It is found in various degrees:

(a) As a cup-shaped concavity of the fundus.

(b) The depressed fundus may lie within the cervical canal or partly in the vagina.

(c) The body of the uterus, turned inside out, may lie in the vagina or partly protruding through the vulva.

In order that the uterus may become inverted, the normal contraction and retraction must be absent, partially or completely. The organ may be found momentarily in this softened condition in normal cases immediately after the fetus is expelled, but in the great majority of cases, when a longer period of deficient contraction and retraction exists, some factor has been in operation producing the inertia—*e. g.*, precipitate labor, prolonged labor, hydramnios, twins, excessive child-bearing, etc. Inversion is impossible if normal retraction and contraction occur. When partial inertia exists, it is generally believed to affect that part of the uterus to which the placenta is attached. When complete inertia occurs, inversion may be caused in various ways. There may be traction on the cord, while the placenta is still attached, if the delivery take place while the woman is standing, or if the cord be naturally or accidentally very short and the birth take place in any position. Apart from spontaneous production, inversion may

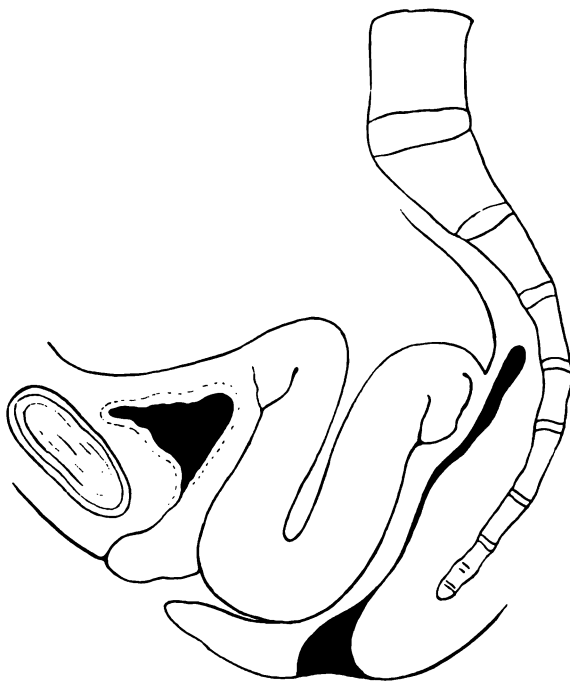


Fig. 290.—Inversion of the uterus.

be caused by artificial traction on the cord or on an adherent placenta when there is inertia of the uterus. If the latter conditions be not present, it is unlikely that inversion can be produced. It is stated by several authorities that occasionally spontaneous inversion may be caused by excessive intra-abdominal pressure—*e. g.*, straining or coughing.

External manipulations of the uterus through the abdominal wall, for the purpose of compressing the organ or expelling the placenta, may cause inversion. In cases of partial inertia of the uterus, usually of that portion to which the placenta has been attached, inversion may be brought about spon-



Fig. 291.—Inverted uterus with fibroid attached to fundus.

taneously through contractions in the surrounding more active uterine musculature. The placental site of the wall, remaining inert, is depressed within the uterine cavity. If the placenta be still attached, its weight also tends to invert the wall still more. The intestines also sinking into the inverted uterus help to promote its descent. Traction on the cord or placenta or faulty manipulations of the fundus through the abdominal wall may initiate or promote inversion in these cases.

Course and Results.—

In the majority of cases the inversion, whether partial or complete, is rapidly produced. Occasionally, however, the change is very gradually brought about, a marked inversion being produced only during the course of several days. In all cases there may be hemorrhage, which at times may be very serious. In complete inversion the uterine mass may become gangrenous, or infection may occur, and inflammation and ulceration of the surface may be extensive; secondarily, peritonitis may follow. Death may be due to shock, loss of blood, or sepsis. Rarely spontaneous reposition of a partial inversion may occur. Sometimes the gangrenous inverted portion may slough off. Occasionally a condition of chronic inversion may develop. Cross has studied 400 reported cases and states that the mortality is nearly 35 per cent., death occurring soon after the inversion or within a period of three or

four weeks; of those dying within a few hours, the majority succumbed within half an hour.

2. In the case of tumor growth, *e. g.*, malignant infiltration of the upper part of the corpus uteri, inversion may be brought about as a result of the weakening of that portion of the uterine wall which is affected, and which becomes depressed toward the uterine cavity. The same thing may be produced by a tumor becoming polypoid in the cavity, *e. g.*, fibromyoma, or, indeed, also sometimes by sessile tumors.

The part of the wall whose muscle is weakened by the growth is gradually forced down by the activity of the neighboring musculature and also by the intra-abdominal pressure.

Pathology.—In suddenly produced inversion the inverted portion may lie in the vagina or even partly protrude through the vulva, and appear, glistening and smooth if still covered by the placenta and membranes, or raw, red, soft, and bleeding if the latter are absent; while in other cases, again, the placenta may only remain partially attached. The raw surface is irregular, and clots may be sometimes seen in the open blood-sinuses, and also the openings of the tubes may be visible. On palpation the mass is found to vary in consistence, being alternately soft and compressible or hard when the musculature is contracted. The cervix may be palpated as a loosely encircling collar around the inverted mass or as a tight constriction; it may itself be partly inverted, but never completely so. The uterine mass is often very dark, owing to excessive engorgement, and its tissues sometimes become very edematous. In the more slowly produced condition various stages are found, *viz.*, from a mere cup-shaped depression on the peritoneal surface where the inversion takes place, to the well-advanced stage in which the mouth of the cup usually resembles a slit. As in the rapidly formed condition, the inverting portion (generally the fundus) may extend as far as the cervix, or even through it; the cervix may also be either loosely felt around the inverting mass or may form a tight constriction, or, indeed, be partly inverted, though its complete inversion probably never occurs. The vagina may also become partly inverted. When an inverted uterus lies in the vagina, it may look like a fibroid polyp, but it is, in the early stages, more congested, softer, and bleeds easily when handled; or the mucosa may be much inflamed and ulcerated, or may be gangrenous. In old cases it may take on the characters of the vaginal epithelial covering, losing its glands and becoming firm.

The ovaries and tubes, and even intestines, may lie in the cup-shaped depression on the peritoneal surface. In old cases they are usually withdrawn. Adhesions rarely form between the peritoneal edges of the depression, which may become very narrowly contracted. If there be a prolapse of the uterus as well as an inversion, the bladder is dragged downward.

Symptomatology.—When an inversion is slight, there may be no symptoms whatever, though there may be more or less hemorrhage. When the inverted portion reaches the cervix, the patient perhaps complains of distress or pains, though even then these may be absent. In the cases of complete inversion the patient may have a sensation as if something had given way; and there may be severe pain, hemorrhage, and collapse. A mass is felt in the vagina by the patient, and there may be marked desire to urinate, though, sometimes, retention of urine may be present. If infection occurs, the usual

signs and symptoms of sepsis develop. Occasionally complete inversion may be produced without any special signs or symptoms whatever.

In chronic inversion there is menorrhagia, metrorrhagia, leukorrhea, bearing-down and other pains in the pelvis. The patient often becomes very weak and anemic; also reflex and neurotic symptoms may develop.

Physical Examination.—Bimanually the normal convexity of the fundus is found absent and a depression is felt, varying according to the extent of the inversion.

Diagnosis.—Bimanually, in advanced cases, a mass can be felt in the vagina, with the characters already described. It is somewhat molded by the vaginal walls. The rim of the cervix may usually be distinguished, and the finger may be passed up around the inverting portion for a certain distance in some cases, while in others this is impossible, owing to either the contraction of the cervix or to adhesions between it and the inverted mass. If the inversion has not yet passed the cervix, the vaginal finger may be passed into the cervical cavity and recognize the condition, while the outer hand feels the cup-shaped depression through the abdominal wall and notes that the fundus is absent.

Differential Diagnosis.—The condition must be diagnosed from—

1. *Intra-uterine polyp.* When such a growth is felt within the cervix, especially if it be of a fibroid nature, it may easily be mistaken for an inverted uterus by the internal finger, but a careful bimanual examination reveals the uterine fundus, which is felt to be rounded and not depressed.

2. *Uterine polyp extending into the vagina.* This condition cannot be long mistaken for an inverted uterus if the bimanual examination be made carefully, for the undepressed fundus definitely establishes the absence of inversion.

3. *Uterine polyp with inversion,* however, is a condition which may easily be mistaken for a pure inversion, especially if the tumor be small and sessile, but when it is large or pedunculated, its nature is usually easily identified. In such cases the most careful bimanual examination should be made under anesthesia in order to estimate accurately the depth of the depression in the uterus.

4. *Prolapsus uteri.*—This condition is mistaken for inversion only when a careless examination is made. Sometimes in a chronic prolapse the os uteri becomes closed, but even in such an event there is, however, usually a dimple representing the os, and on bimanual examination the undepressed fundus is found. A sound passed into the bladder is found to descend in front of the prolapsed uterus, whereas in inversion this is not the case.

5. *Inversion with prolapsus uteri.* This condition is determined only by making a careful bimanual examination and by studying the relationship of the bladder to the uterus.

Treatment.—(a) *In Recent Cases.*—Inversion of the uterus in the third stage should almost never occur if labor be conducted properly. The causes of uterine inertia should be prevented as much as possible; if this complication exists, special care should be taken to induce retraction and contraction. The fundus should not be depressed by the manipulations through the abdominal wall. The cord and placenta should not be pulled until separation from the uterine wall is insured. Frequent examinations of the uterus through the abdominal wall should be made.

When a partial inversion exists, reposition is easily brought about by bimanual manipulations. If the placenta be attached, it should be removed by the fingers. When complete inversion exists, it should be reduced as soon as possible; in order to do this the patient should be anesthetized, placed in the lithotomy position, and a thorough aseptic technic observed. The rectum and bladder should be empty, and the placenta should be removed, if attached, before reposition is attempted. In carrying out taxis the following procedure may be adopted: One hand is placed on the abdomen, steadying the cervix, while the other grasps the inverted fundus, pushing it up, reducing the inversion in the inverse way of its occurrence, and following the axis of the pelvis. If this method fail, an effort may be made to depress the wall of the uterus at a point near the cervix, making the rest follow gradually, while the other hand endeavors to enlarge the cervical ring through the abdominal wall, or the fundus may be locally depressed upward and reduction of the inversion follow. Should reposition fail by these manipulations, the patient should be kept in bed on a low diet for several hours, hot antiseptic douches or fomentations being applied to the inverted uterus. The bowels and bladder should be thoroughly emptied, and manipulations under the strictest antiseptic precautions should again be attempted. If these fail on account of the tightness of the constricting cervix, the latter should be divided in the median line, anteriorly or posteriorly, or, indeed, in both places, in order to facilitate reduction. In all manipulations the uterine wall must be handled gently lest it be torn, perforated, or injured. After reposition it is always advisable to tampon the uterine cavity for forty-eight hours. In two days the tampon is removed, a daily hot intra-uterine antiseptic douche is given, ergot being administered by the mouth. The patient remains in bed according to the needs of the conditions present, *e. g.*, if it is a puerperal case, for at least twelve or fourteen days; if not, about eight days, unless a tumor has been removed, and then for two or three weeks.

(b) *In Chronic Cases.*—Previous to the attempt to replace the uterus the patient should be kept at rest in bed for a few days, the bowels being moved regularly. If the inverted uterus does not extend outside the vulva, a sterilized Barnes' bag should be distended in the vagina each day. This may be sufficient to cause the uterus to be reduced, or, if not, it at least causes the vagina to be stretched so that there is more room for the necessary manipulations required. The night before the operation a cathartic should be administered, followed the next morning by an enema, the rectum being afterward washed out with boric-acid solution. Morphin should then be given, and the patient anesthetized and placed in the lithotomy position. The antiseptically prepared vagina is well lubricated with aseptic vaselin, and the bimanual manipulations already described attempted. Sometimes, by pressing a forefinger into the rectum, the uterus may be steadied and counter-pressure may be made. Some, in addition, advise passage of the other forefinger into the bladder.

When the hand gets tired of pressing up the fundus, the pressure on it may be continued by means of a cup and stem attached to a spiral which is supported against the operator's chest. It may be advisable to pull the cervix down with a volsella, and sometimes incisions in it assist the manipulation.

If only partial reposition can be obtained at one sitting, the patient should

be put to bed, a Barnes' bag being first placed in the vagina to hold the amount of reduction attained from being lost, and opium administered per rectum to keep the patient quiet.

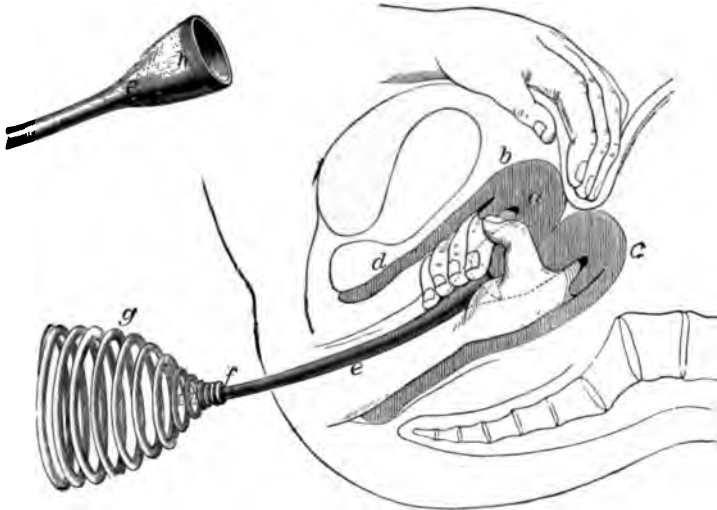


Fig. 292.—White's repositor, with elastic spring, placed against the operator's chest: *a*, uterus; *b*, bladder wall; *c*, peritoneum; *d*, urethra; *e*, stem of instrument; *f*, junction of stem and spiral; *g*, spiral spring.

When manual manipulations fail to replace the uterus, continuous slight elastic pressure may be kept up by means of the cup and curved stem attached by means of elastic bands, passing from the latter to an abdominal belt. A pad soaked in antiseptic vaselin is first placed in the cup, which is to make pressure against the inverted fundus, always in the line of the axis of both the uterus and the pelvis. Counterpressure is kept up by means of a pad placed above the pubes, and held in position by an abdominal band.



Fig. 293.—Cup with stem and elastic bands which are fixed to an abdominal belt, for gradual reduction of inversion (Thomas).

If all these methods fail to bring about a reduction, then radical surgical measures may be adopted. If a malignant or extensive fibroid tumor or bad ulceration or gangrene exists in the wall, then amputation or extirpation should be performed. In any case the most thorough disinfection of the uterus and vagina should be made.

Amputation.—The patient is placed in the lithotomy position. The inverted fundus is steadied with a volsella, and the

natural neck of the inverted portion carefully determined. The neck is then pierced with a pedicle needle, carrying a strong double silk ligature; when the

needle is withdrawn, the ligature is divided into two equal parts. These are interlaced so as to embrace the neck, and then tied on each side.

The neck is then grasped three-eighths of an inch below the ligatures with two pairs of forceps, and the uterus cut away below them. If there be any bleeding from the stump, the neck is again tied with one of the ligatures already passed. Then the ligatures are cut short, the forceps removed, and a chinosol gauze tampon placed in the vagina. This is removed in two days, and an antiseptic douche is afterward given daily. There is some risk that the stump may spring back into the pelvis and the wound burst open.

Extirpation.—This should undoubtedly be performed if sloughing, gangrene, or malignant disease exists in the uterus.

If there be no infection, gangrene, malignant or extensive fibroid growth, it may sometimes be possible to effect replacement by the aid of incisions.

Hirst operates by splitting the posterior cervical lip as high as is necessary to gain space for the reduction of the inversion, the incision being afterward sutured. If this method does not suffice, the following may be tried, viz., divide the cervix in the middle line anteriorly. This incision is continued into the anterior wall of the uterine body far enough to allow the inversion to be reduced. The incision may then be closed with chromicized catgut and the uterine cavity packed with gauze. If a large part of the incision cannot be readily closed in this way, a T-shaped anterior colpotomy opening may be made, the bladder elevated, the anterior uterovesical cul-de-sac opened, in order that the incision in the uterine body may be closed.

CHAPTER XVII.

FIBROMYOMA UTERI.

Definition.—A benign circumscribed tumor of the uterus, consisting of muscular and fibrous tissue in varying proportions. The majority of such tumors are very hard, and are hence often described as “fibroid.” Various other terms have been used, *e. g.*, fibrous tumor, fibroma, leiomyoma, hysteroma, myoma, grossesse fibreuse, myoma lævicellulare.

Frequency.—It is difficult to estimate the frequency of occurrence of fibroid tumors. In all probability they are more common than is generally stated, because in so many cases they cause no symptoms and are never diagnosed in life. Bayle states that they occur in 20 per cent. of all women over thirty-five years, and Klob estimates that they are present in 40 per cent.



Fig. 294.—Pedunculated fibroid mass attached to posterior surface of uterus near fundus.

over fifty years of age. In the records of 1860 autopsies on women over thirty made at St. Bartholomew's Hospital, Champneys found that fibroids existed in 8 per cent. In 2230 gynecologic cases recorded during a number of years at the Edinburgh Royal Infirmary Haultain found that 8 per cent. were diagnosed as fibroids. Herman states that about 7.5 per cent. of his female patients over thirty-five seek advice for fibroids.

Situation.—Fibroids may develop in any portion of the uterus. In the great majority of cases they are found in the corpus uteri. Courty, in a series

of 131 cases, found 84 per cent. corporeal and 16 per cent. cervical. Schroeder found 8.1 per cent. cervical; Lee estimated the latter at 5.4 per cent. As regards the corporeal variety, the fundus and posterior wall are more frequently the site than the anterior wall.

Age.—It is rare to find fibroids as early as the twenty-fifth year. Very few have been discovered under twenty. Sasaki has met one case of large multiple growths in a girl of nine. Gusserow has described 1 case at ten, 1 at fourteen, 1 at sixteen, 3 at eighteen, and 8 at nineteen. Pick has described a case of congenital myoma.

In 100 cases analyzed by R. Williams it was found that the average age at which symptoms were first noticed was thirty-seven and one-fourth years. Generally speaking, it may be stated that fibroids tend to develop most during the last third of the active reproductive period.

Structure.—The fibrous and muscular elements vary somewhat in their proportions in different cases.

The *hard fibromyoma* is the most common variety, and contains a large percentage of fibrous tissue. It is most frequently multiple, and varies greatly



Fig. 295.—Section across portion of uterus containing an interstitial fibromyoma.

in size. The smallest tumors are composed of an irregular interlacing of fibrous tissue and nonstriped muscle. In the larger masses the tissue is usually grouped in nodules or *whorls*, and between these and surrounding the whole mass is connective tissue which connects the tumor with the wall of the uterus proper. The latter may be said to form the capsule of the tumor. The subcapsular connective tissue varies in density, and is, for the most part, loose, though at one point it is usually somewhat thickened. The blood-vessels are comparatively few, and extend from the capsule into the tumor, and lie in the connective tissue between the whorls. Many of the arterioles appear to end in the center of the latter. The larger the fibroid, the thinner is the uterine musculature covering it; and in those which protrude on the peritoneal surface (subperitoneal) or into the uterine cavity (submucous) it may be regularly or irregularly thinned so as to be almost unrecognizable; or, indeed, it may have almost entirely disappeared.

On section the fibroid tumor cuts somewhat like cartilage, the macroscopic cut surface having a pale, satin-like appearance, and, in large masses, many whorls are usually distinctly visible. Surrounding the tumor is the darker capsule, and in it gaping veins are seen. Few vascular points are found in the substance of the tumor itself, though rarely many dilated capillaries are visible, giving rise to an angiomatous appearance; such a tumor has been termed the "telangiectatic myoma," or "myoma cavernosum." A lymph-angiectatic growth containing many lymph-spaces may occasionally be met with. The pedicles of pedunculated fibroids may contain large arteries, which tend to contract and retract when cut across.

On microscopic section the muscle-cells are fusiform in shape, with elongated, rod-shaped nuclei; on transverse section these latter, if numerous, present a kind of mosaic appearance, which might be mistaken for a

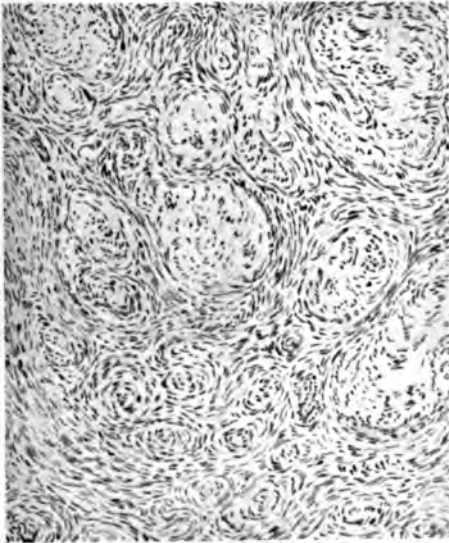


Fig. 296.—Fibromyoma of uterus ($\times 86\frac{1}{2}$).

collection of round, nucleated cells. Between the muscle-bundles connective tissue, poor in cells, is arranged; in some cases it is found in bundles. Nerves pass into the tumor; their endings have been found in the muscular fibres. Lymphatics also exist. Masses of epithelial cells may occasionally be found in fibroids and are probably mostly inclusions of early Wolffian or early Muellierian epithelium, though in some instances they may be derived from the deep-lying ends of glands of the uterine mucosa.

By many writers a special form of fibromyoma has been described as the *soft fibroid*, consisting almost entirely of muscular tissue. Probably no such variety really exists, the soft red tumor thus designated being one in which

necrobiosis has begun, the tissues becoming softened and stained, owing to the breaking up of the red blood-corpuscles and the dissemination of the pigment. Clinically, fibroids may also be described as soft when various other degenerations exist in them. Possibly, also, the unencapsuled adenomyoma of Recklinghausen may sometimes be described in this category.

Etiology and Development.—Little is known regarding the causation of fibroids. They are usually discovered between the ages of thirty-five and forty-five; more seldom they may be found before twenty-five; and almost never before puberty. They do not develop anew in castrated women or after the menopause. They are not more common in the married than in the unmarried. As to the starting-point of fibroids, there is a general belief that it is to be found in connection with the blood-vessels. Kleinwächter, in studying small nodules, thought he could recognize in the band connecting

the fibroid with the normal uterine tissue an obliterated capillary, and stated that, surrounding the vessel, the process of muscle-cell formation could be made out. Pilliet states that the adventitia gives rise to a zone of embryonic cells which develop into concentric rows of muscle-fibers, the outermost layers being transformed into fibrous tissue from lack of proper nourishment. Galippe and Landouzy believe that micro-organisms are the primary cause of this proliferative change. Pilliet also makes a similar statement regarding a case of his. Leguen and Marien and Gottschalk have insisted upon the importance of inflammation in the production of fibroids. Ricker holds that they arise from abnormal growths of muscle around remains of the Wolffian ducts or around epithelial relics of the Muellerian duct. Von Recklinghausen has drawn special attention to spaces lined with columnar or cubic epithelium found in some fibroid tumors, and believes them to be Wolffian in origin; Meyer supports this view, and has described these remains in the uterus of the new-born as well as in that of the adult. Others, however, believe that these spaces are derived from the uterine mucosa and, therefore, Muellerian. Bishop believes that while some tumors may arise from these embryonic remains, the majority are derived from blood-vessels in the manner described by Pilliet, and, in favor of the latter's view, he mentions the fact that in the ordinary hard fibroid there is usually only one connective-tissue pedicle through which vessels enter the tumor. Further, he points out that when calcification occurs in fibroids, it almost always begins at the periphery which is furthest away from the blood-supply, and also, if the vessel supplying any nodule becomes plugged, necrobiosis occurs in the whole nodule, which softens and liquefies, leading to the formation of a cavity into which surrounding nodules tend to project. He states further that the whorled appearance is strongly suggestive of a vascular development, many of the uterine vessels being markedly convoluted.

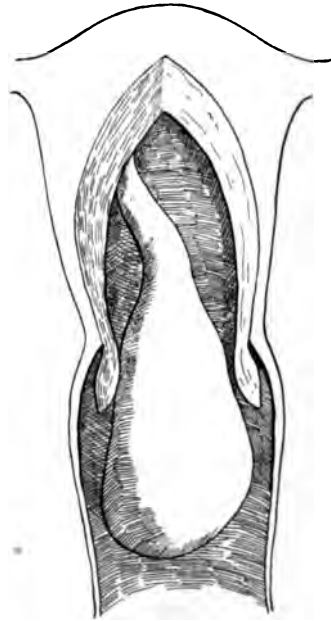


Fig. 297. — Fibromyomatous polyp growing from uterine wall into the vagina.

The method of the development of the telangiectatic and lymphangiectatic tumors is not well understood. Senn believes them to be derived from a matrix of angioblasts. These latter may be in the walls of the vessels, and may become displaced outward, giving rise to new vascular channels and spaces. Weil has traced the extension of new vessels from older ones.

VARIETIES.

It is convenient clinically to consider fibroids in two classes, viz., those arising in the body of the uterus and those which are cervical in origin.

1. **Those Arising in the Corpus Uteri.**—These form the great majority

of fibroids. It is usual to study them according to their situation and the direction of their growth, viz., interstitial, subperitoneal, or submucous. This classification is an artificial one, as it must be remembered that practically all are interstitial in the beginning. A much larger percentage grow outward toward the peritoneal surface than inward toward the uterine cavity.

(a) *Subperitoneal*.—These tumors, growing outward toward the peritoneum, may remain sessile or later become pedunculated. The pedicle may vary greatly in length and thickness; consequently, the tumors vary much as regards range of movement. If a tumor grows upward, having only a short pedicle, it tends to elevate and elongate the uterus; sometimes the uterus may also undergo marked torsion, or may be partly or even completely divided by such traction. In other cases torsion may occur without much elongation.

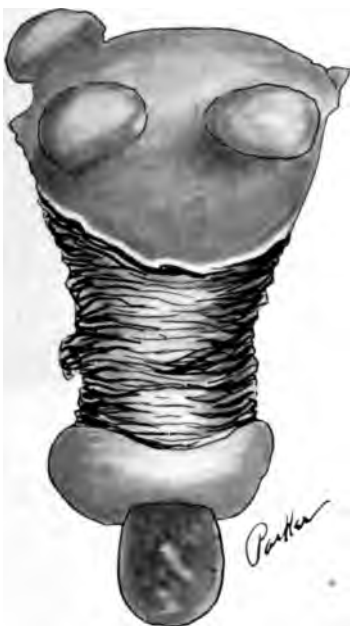


Fig. 298.—Uterus with pedunculated fibroid projecting through cervix, and with small subperitoneal growths near fundus.

Again a tumor may lie in the pelvis from the beginning, or may gradually descend as its pedicle elongates until it becomes incarcerated or adherent. A subperitoneal tumor may also grow laterally into the broad ligament. Adhesions may take place, due to peritonitis, and ascites occur. Adhesions to the great omentum and intestine are the most frequent, sometimes a loop of gut being very intimately united with the tumor-wall. These adhesions may even lead to increased growth in the tumor. A thin pedicle may be entirely divided, *e. g.*, in pregnancy or labor, or as a result of torsion. Torsion causes congestion and edema of the tumor, and, usually, inflammation of the serosa covering it; in some cases complete necrosis results. In some cases after division of a pedicle the tumor may continue to develop, being nourished through adhesions which have formed around it. Such separated fibroids may be found in any part of the peritoneal cavity. Usually they are only small in size, though I have found one measuring eight inches (20 cm.) in diameter. They are frequently somewhat calcified. Sometimes

they become infected and cause peritonitis. In many of these pedunculated subperitoneal tumors there are but few vessels in the pedicle, and they tend to grow very slowly, and often become very hard. Ordinarily they do not reach a large size, but occasionally they may. Spencer Wells described one which weighed 34 pounds. These tumors are apt to become edematous, cystic, or calcareous.

(b) *Interstitial*.—These are the tumors situated in the uterine wall which, as they grow, cause the uterine wall to expand somewhat equally around them. Many may be found in the same uterus. As they grow they displace the peritoneum outward and the mucosa inward, so that sometimes it may be

difficult to distinguish them from the subserous and submucous forms. It is best to denominate as interstitial only those tumors in which the capsule is of equal thickness all around. As they grow, they tend to bring about a marked hypertrophy of the uterus. The uterine wall may often be found thinned at one place, either on the peritoneal or the mucosal side.

Where there is only one large intramural fibroid, the whole uterus is somewhat rounded, while if there are several, it is irregular. The uterus may be displaced in various directions; sometimes it may be flexed. The tumor may grow downward into the pouch of Douglas or into the cervix and vagina, or it may gradually fill up the pelvis, while in other cases it may grow laterally into the broad ligament.

(c) *Submucous*.—These are the tumors which tend to project especially into the uterine cavity. They are most frequently at or near the fundus. Great variations are found in the size of the tumors, as well as in the size of



Fig. 299.—Uterus enlarged by fibroid tumors, with bilateral tubo-ovarian abscess.

the pedicle, the latter often varying considerably in length. The uterine wall is increased in area, but is usually thinned at the site of the pedicle, and may even become inverted. These tumors are covered with the uterine mucosa, and a thin layer of musculature which helps to form a capsule; this may be very thin in places and, indeed, sometimes no muscular covering exists.

In the early stages the mucosa covering the tumor is hypertrophied, as is that of the rest of the uterine cavity; but as the tumor increases in size it usually atrophies. Uterine muscular contractions tend to force the tumor more and more into the cavity of the organ. This is often most marked during the engorgement due to menstruation, when the tumor, being congested and enlarged, stimulates the uterine musculature to increased activity. A pedunculated submucous tumor is usually round or ovoid in shape, generally the latter, and is softer and more vascular than a subperitoneal tumor and less prone to fibrous, calcareous, and cystic changes. It is rare to find more

than one submucous polypoid growth in the uterine cavity, though after one is expelled or removed by operative procedure, another may gradually develop. Owing to the constriction of the cervix, as the tumor is driven downward it may become shaped somewhat like an hour-glass.

Sometimes the capsule and mucous covering of the tumor may be gradually thinned and rupture, so that spontaneous enucleation and expulsion may follow. It may also ulcerate through. Adhesions may take place to the wall of the uterus as a result of denudation due to inflammation or ulceration. In the process of enucleation the pedicle may in some cases become so constricted by the contraction of the musculature of the capsule around it that gangrene and suppuration may follow. This may also follow infection from ulceration or from operative procedures.



Fig. 300.—Submucous fibroid attached to fundus of uterus.

2. Those Arising in the Cervix.—Fibroids rarely occur in this situation. They may develop in any position in the cervix. Roger Williams states that they are most frequent in the upper and posterior part. If in the lower part of the cervix, they may give it a rounded or elongated shape or may become polypoid, and project into the cervical canal or into the vagina.

Tumors developing in the upper part of the cervix may grow posteriorly under the pouch of Douglas, or anteriorly between the bladder and uterus, or laterally into the broad ligaments. Various structures may in this way be displaced, and the pelvis may become gradually filled up and the cervical canal greatly distorted.

When the tumor reaches a considerable size, it has usually an elliptic con-

tour from above downward, the body of the uterus being attached as a knob to the upper surface. Bishop believes that cervical growths develop more rapidly than those in the body, because of the more direct and free blood-supply. They are rarely associated with tumors in the body.

GROWTH IN FIBROIDS.

The conditions which regulate the growth of fibroids are not well understood. The rapidity of increase in size varies greatly; in general it is slow. Some grow steadily, others intermittently, while others again cease to enlarge after a certain period or, rarely, may even decrease in size. Schosler states that a tumor will not grow sufficiently large to be recognizable in less than three months, while it may not be much larger than that at the end of a year. In five years' time it may reach the size of a fist, and in thirteen that of an adult head. In pregnancy, rapid increase may sometimes occur, while during the uterine involution of the puerperium there may be considerable diminution in size or even entire disappearance of the tumor has been noted. A submucous tumor may be expelled entire after labor or may become softened from necrosis or infection and gradually disintegrate and escape. At the menopause some tumors cease to grow, but many others continue to increase after it. Before the climacteric, *i. e.*, during the sexual period, diminution may occasionally be noted apart from the influence of the puerperium or treatment. With regard to disappearance by absorption it is difficult to speak positively. In making observations on this point it is important to exclude cases like the following:

1. Those in which a subperitoneal tumor has become separated from the uterus and transported to some other part of the peritoneal cavity.

2. Those in which a submucous growth has been expelled *en masse* from the uterus, or has necrosed and discharged piecemeal.

In many instances, no doubt, the supposed tumor has been a hemorrhagic or inflammatory swelling.

As regards increase in size, care must be taken to distinguish actual growth of the solid tumor from the following:



Fig. 301.—Fibroid polyp projecting from the cervix.

1. Edema.
2. Cystic or other degeneration.
3. Associated pregnancy.
4. Hemorrhage into the tumor.
5. Associated tumors, *e. g.*, ovarian cystomata.

There can be little doubt that, apart from pregnancy and degenerations, the most common cause of variation in the size of solid fibroids is the condition of the circulation. Not infrequently it may even be noted that a period of rest in bed leads to an appreciable temporary diminution in the bulk of a fibroid. They may also increase with the menstrual congestion, and decrease at the end of the period. We are in doubt as to the frequency of temporary edema as a cause of increase.



Fig. 302.—Uterine fibroid with cystic and necrobiotic areas.

While fibroids may reach a considerable size, *e. g.*, 10, 20, 30 pounds, they seldom grow as large as ovarian cystomata. Almost all the largest uterine tumors recorded have been cystic fibroids (*vide* p. 549). The largest solid fibroid known to the author is one removed by McIntyre, which weighed 106 pounds; the girth of the woman's abdomen was 50 inches. It is very rare to find a tumor above 40 pounds in weight.

PATHOLOGIC CHANGES IN FIBROIDS.

Sclerosis or fibrosis, *i. e.*, hardening of fibroids by increase of dense fibrous tissue and diminution of muscular tissue, is especially frequent in the pedunculated subperitoneal varieties, interference with the blood-supply

being the chief determining factor in its formation. This change is common after the menopause. The induration is frequently associated with diminution in the size of the tumor.

Meslay and Hyenne have described the appearance presented as follows:

In some parts there is a marked increase of fibrous tissue between and around the nodules. In different places extensions of this tissue invade the nodules, splitting up and compressing the muscular tissue. In some cases the growth of fibrous tissue is irregular. Vessels are gradually compressed and the circulation interfered with.

Calcification.—In rare cases a deposit of lime salts (phosphate and carbonate) is found in fibroids, especially in the pedunculated growths with narrow pedicles and in the detached tumors. Such transformed masses have long been known as “womb-stones.” They are rare in interstitial growths, and very uncommon in submucous polypoid tumors. They are most frequently found in women of advanced years. The change is associated with imperfect blood-supply to the tumor, and is usually preceded by more or less fibrous transformation.

Calcification may begin in the peripheral layers of a tumor, a complete shell being sometimes formed in this way; or it may begin at various points throughout the tumor.

Fatty Degeneration.—This change has been occasionally described, but is rare.

Necrobiosis.—Various stages of this degenerative process are found. One of the most interesting is the early stage, in which the tumor is transformed into a soft red mass. There can be little doubt that such a swelling has been wrongly described by most authors in the past as “*soft fibroid*.” Gebhart has described the degeneration as chiefly affecting large interstitial fibroids, the change beginning in the central portion and extending peripherally. There is a softening of the tissues, which become flesh colored by the dissemination of blood-pigment, due to the breaking up of red blood-corpuscles. John S. Fairbairn has made a careful study of 19 specimens and supports Gebhart’s view. He urges strongly the abandonment of the classification of fibroids into “hard” and “soft,” and states that the latter are only those in which some form of degeneration has taken place. Microscopically, he finds impaired nuclear staining, granular and hyaline degeneration, and vacuolation of the fibers. No vascular changes of any importance are noted. In a more advanced stage cavities form in which are remains of broken-down fibers and blood-corpuscles. It is likely that large cavities may develop, giving rise to one of the common cystic growths. Fairbairn states that these tumors are not engorged with blood, and that vascular changes probably do not explain the degeneration. He points out that the process occurs most frequently during the child-bearing era, and that pregnancy exercises a predisposing influence in its production.

Inflammation; Suppuration; Gangrene.—These processes follow infection as a rule. The infecting organisms may be introduced from the adherent bowel, Fallopian tube, or uterine cavity, or may be introduced during operative procedures. Tumors of low vitality are especially apt to be involved, *e. g.*, pedunculated submucous fibroids with constriction of the pedicle; ulceration of the latter may sometimes precede infection of the whole

tumor. Infection may also be introduced in connection with abortion or labor.

The septic process may be localized in the tumor or may involve other structures. A general infection may follow.

A suppurating tumor may be discharged through the uterine cavity, through the bladder or bowel, or into the peritoneal cavity.

Myxomatous Degeneration.—This change rarely occurs in fibroids. Virchow pointed out that there is a development of mucoid tissue. As a result, irregular cavities (pseudocysts) may form.

Edema.—Frequently fibroids become edematous. Meslay and Hyenne have pointed out that there may be simple imbibition of serous fluid in certain parts of the tumor, an accumulation of the fluid in small spaces formed by a separation of the fibers of the tumor, or an accumulation in large spaces formed by a fusion of small ones. The tissues affected become swollen and degenerated, losing their normal staining reactions. Bishop states that the degeneration usually commences in the internodular connective tissue, and that the cavities have no endothelial lining. In the fluid Meslay and Hyenne found:

Albuminoids	69 per 1000
Salts (sodium chlorid, sodium carbonate)	7 per 1000
Mucin, creatin, and creatinin are absent.	

Moschuna states that these changes are generally found in women with arteriosclerosis. They are associated with an increase in the bulk of the tumor and with softening. By many the degeneration has been termed "myxomatous," but this description is inaccurate.

Telangiectasis and Lymphangiectasis.—Occasionally, there may be an increase in the size of the capillaries or the lymphatics in fibroids, especially in soft tumors, giving rise to dilations. Virchow gave the name of myoma telangiectodes to the variety in which blood-spaces are abundant. On gross section such a growth has the appearance of cavernous angioma. These tumors may pulsate and vary in size from time to time. Fehling and Leopold have particularly drawn attention to the lymphangiectatic variety.

Hemorrhage.—There may be found in some fibroids dark-colored areas resembling early infarcts, and, indeed, they may be of the latter nature; also rarely, actual blood extravasations may be encountered. These may occur after the torsion of a pedicle, but when marked, are usually in connection with cystic fibroids. Rapid increase in the size of the tumor may thus be caused.

Softening.—This term is used to describe a variety of changes occurring in fibroids, *e. g.*, edema, myxomatous and fatty degenerations, necrobiosis, suppuration, telangiectasis, lymphangiectasis, sarcoma.

Within recent years careful studies of degenerations in fibroids have been made by Martin, Cullingworth, Noble, and others, who point out that their frequency is greater than has been supposed. Thus Scharlieb, in 100 cases of fibroids, found 26; Cullingworth, in the same number, found 52; Noble, in 258 cases, found 47, including malignant changes found in the uterus. In a series of 210 cases treated surgically by the author the following degenerations were found:

	CASES.
Calcareous.....	2
Cystic.....	13
Edematous.....	6
Myxomatous.....	4
Suppuration.....	10
Adenocarcinoma of cervix.....	1
Sarcoma.....	2
Hemorrhage.....	3
Necrobiosis.....	11
	<hr/> 52

Fibroids in Relation to Malignancy.—There have been some differences of opinion as to the exact relationship of fibroids and malignant growths, some holding that the latter, especially adenocarcinoma of the corpus uteri, occur in the myomatous uterus in a larger percentage of cases than in the non-myomatous uterus. It has also been freely stated that the fibroid tumor may undergo direct transformation into sarcoma and carcinoma. In 1068 cases reported by Noble, Cullingworth, Scharlieb, Frederick, and McDonald, sarcoma was present in 20, carcinoma in 40, and syncytioma in 2 cases.

Carcinoma.—Cancer may develop in connection with the epithelium of the cervix or body in a uterus which is the site of fibroids; indeed, the latter growths may be invaded by a malignant tumor, just as may a nonfibroid portion of the uterus.

When cancer begins to develop in the body of the uterus near a fibroid, its presence may not be suspected for a long time. In such cases, if the disease be advanced, it might easily be considered as having arisen as a transformation of the fibroid, and that the uterine mucosa had been invaded secondarily. Such a mistake could scarcely be made if the uterus were carefully examined in the early stages of the carcinoma.

It is unlikely that cancerous transformation of the fibrous or muscular tissue of a fibroid ever occurs, but there is no reason why it may not begin in connection with the epithelial inclusions frequently found in connection with fibroids, whether they be derived from the early Wolffian or Müllerian tracts or from the deep ends of glands of the developed uterine mucosa.

Whatever be the site and origin of cancer, it is rarely associated with fibroids. Roger Williams found in 78 autopsies for uterine cancer only 5 concurrent myomata; and Lebert, in 45 cases, noted only 6. In the great majority of these the fibromata and carcinomata were absolutely independent of one another. Williams has found fibroids more frequently associated with cancer in other organs, *e. g.*, in the breast. It is highly probable that the presence of fibroids does not predispose to the development of carcinoma in any part of the uterus.

Sarcoma.—There seems little doubt that very occasionally sarcoma may originate in the tissues of a fibroid.

Roger Williams, in studying 2649 consecutive cases of uterine neoplasms, found a record of 481 myomata and only 2 sarcomata. In 409 specimens of myomata Fehling found only 2.2 per cent. affected with sarcoma. Williams states that the most frequent variety of the disease is myosarcoma, in which round- and spindle-cells predominate, being mixed with fibrous tissue and non-stripped muscle. They are usually subperitoneal or submucous polypoid forms, but may be interstitial, and are nearly always encapsulated.

Schauta has described sarcomatous development in a fibroid eleven years after castration. Cases described as myoma malignum, in which the cells are believed to be identical with muscle-cells, are probably sarcomata whose cells may closely resemble those of nonstriated muscle. Evelt, who has studied 120 collected cases, says that the sarcomatous change begins in the muscle and not in the connective tissue; in only one of these cases was the growth melanotic. Sarcomatous development in fibroids may be associated with the myxomatous, and cystic as well as the other changes found accompanying these malignant growths in other parts of the body.

Occasionally sarcoma may develop in a fibroid secondary to the same disease elsewhere. In a case of hysterectomy for fibroids performed by the author sarcoma was found in the centers of three independent interstitial fibroids. The patient recovered from the operation, but died in a few months from malignant disease in the lung. Previous to the operation there had been one spell of slight hemoptysis, though no physical signs of changes in these organs could be detected at that time; there can be little doubt that the disease was primary in the lung in this case.

COMPLICATIONS OF FIBROIDS.

Changes in the Uterus.—The shape of the uterus varies according to the size, site, and number of the fibroids. Occasionally the enlargement may be symmetric in the case of an interstitial or submucous growth, but most usually, however, fibroids cause asymmetric uterine enlargement. Multiple interstitial growths may obliterate the greater portion of the normal uterine structure; usually there is elongation of the cavity, associated with hypertrophy of the uterus.

Hypertrophy of the uterus is especially marked in cases of large submucous and interstitial tumors. Kelly has reported a case in which, with a tumor of moderate size, the uterus, apart from the fibroid, weighed 645 grams (normal weight being about 46 grams). Displacement of the uterus by the tumor may occur in any direction. It may become twisted (torsion) on its long axis, in some cases being partly or entirely severed from the cervix. Inversion may be caused by a submucous polypoid fibroid. Occasionally, there is an obstruction to the outflow from the uterus and fluids may accumulate in it, giving rise to hydrometra, pyometra, or hematometra. Pressure of one or more fibroids may cause marked atrophy of the uterine musculature.

The changes in the **uterine mucosa** vary. In the majority of cases there is hyperplasia, which is often wrongly stated to be of inflammatory origin. Of course, true inflammation may be an associated condition in some cases. All the elements of the mucosa may be increased, and many variations of this may be found. In some cases a mucosa of the thickness of half an inch may be produced, and localized projections extend into the uterine cavity as "mucous polyps." This hyperplasia is most marked in connection with large submucous fibroids. (With the subperitoneal growths, however, even though the uterus be elongated, there may be little or no hyperplasia of the mucosa; indeed, it may be thinned and atrophied.)

When a submucous fibroid projects as a polyp into the uterine cavity, the mucosa covering it usually becomes thinned and may even disappear as a result of stretching or, indeed, sometimes, by ulceration. This condition is

frequently also associated with retraction of the nonatrophied mucosa about the neck of the growth, forming a thick ridge or collar, which is usually very vascular and bleeds easily. Marked pressure of such growths against the uterine mucosa causes atrophy of the endometrium covering the latter at the points of contact.

Relationship of Fibroids.—Small fibroids may lie entirely within the pelvic cavity. As the tumors grow they may extend in any direction—most frequently upward into the abdominal cavity. Much less often they may occupy a large portion of the pelvis without extending considerably above the brim. Large growths which reach a high level frequently so elevate the



Fig. 303.—Fibrocystic tumor growing in the broad ligament. The tube is thickened and adherent.

uterus that the cervix may be reached only with difficulty by the finger per *vaginam*. A subperitoneal fibroid with a narrow or long pedicle may sometimes gravitate early into the pouch of Douglas and there continue to develop and, indeed, may become incarcerated in the pelvic cavity.

A small fibroid situated at the fundus or on the posterior uterine wall may early produce a retroversion; the same displacement may be caused by a pedunculated growth of the anterior wall as it extends upward into the abdomen. More rarely a tumor extends laterally into the broad ligament; and as it continues to develop pushes the uterus toward the opposite side.

The *bladder* varies considerably in its relationship to uterine fibroids. Some-

times it is prevented from filling in a normal manner; or a fibroid of the anterior wall may press upon it or gradually push it forward and upward. Large fibromata extending up into the abdominal cavity may drag it up considerably above the brim, or it may also be displaced to one or the other side.

The *round ligaments* may be considerably altered. One or both may be much elongated; sometimes there is hypertrophy, sometimes thinning. The uterine end of these ligaments may be so stretched over a tumor as to be unrecognizable. The *vagina* may be displaced. It is sometimes drawn upward and elongated; or occasionally it is pushed downward by the weight of a large tumor in the pelvis. It may also be displaced laterally. It may be greatly distended by submucous polypoid growths.

The *ureters* are not infrequently displaced. The lower ends are changed according to the alterations in the position of the bladder. A large intrapelvic fibroid which has become adherent to the broad ligament and lateral

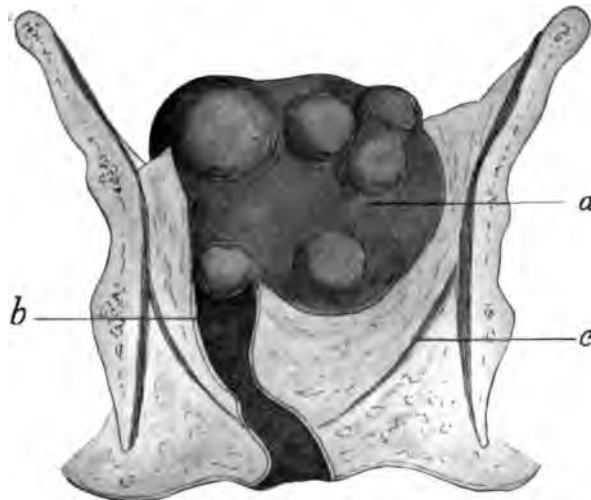


Fig. 304.—Diagram illustrating extension of a uterine fibromyoma into the extraperitoneal tissues: *a*, Fibromyoma uteri; *b*, vagina pushed toward lateral pelvic wall; *c*, levator ani.

pelvic wall may become very closely related to the ureter, as also may an intraligamentous growth. Rarely, a fibroid may grow under a ureter in such a way as to elevate it as the tumor develops.

The *Fallopian tubes and ovaries* are displaced in various ways. Occasionally they may be found with difficulty. If they are adherent to the floor or side wall of the pelvis, the upward growth of a large fibroid may elevate the uterus far from the ovary and outer end of the tube. The last two structures often show traces of inflammation, adhesions being common. The tubes are frequently elongated; sometimes their outer ends may be closed, the lumen being distended with blood, pus, or serum. The *ovaries* are very frequently diseased. Enlargement is common, hyperplasia of the stroma often being marked. There may be a considerable degree of cystic degeneration. The blood-vessels may be enlarged and thickened. Edema is sometimes noted.

Meredith, in studying Lawson Tait's cases, found that in 56 per cent. there was tubal disease, and in 46 per cent. chronic ovaritis. In M'Donald's series of 280 cases there were tubal and ovarian complications in 137. In a series of 210 cases of uterine fibroid treated surgically by the author, the appendages were diseased in 99 instances.

In many cases there is no evidence of infection, and it may be that the etiologic factors are local varicocele and other circulatory disturbances, mechanic irritation, or pressure of the tumor. In some instances there may have been an infection either before or coincident with the development of the fibroid.

The *blood-vessels* of the broad ligament and uterus tend to enlarge, in some



Fig. 305.—Uterus with fibroid attached to its posterior wall. The tumor was adherent in the pouch of Douglas.

cases to a marked degree. The veins especially may form large varicose masses. Edematous areas containing serum are frequent in the broad ligaments, and are thought by some to be distended lymph-spaces.

Peritonitis.—Fibroids rarely cause peritonitis of themselves, but it often follows torsion of the pedicle of a subperitoneal growth or the impaction of a tumor in the pelvis. Peritonitis may also result from intestinal obstruction, from infection entering the peritoneal cavity, from a diseased appendix, tube, or ovary, or from an infective process starting in the substance of a fibroid itself, or elsewhere.

Ascitic fluid in connection with a simple fibroid is rare, but it may occur with torsion of a pedunculated growth or with peritonitis from other causes.

Association with New-growths of Other Organs.—Ovarian cystomata are not infrequently coincident with uterine fibroids. The author noted 12 in a series of 210 cases. Pean found the former in 12.5 per cent. of cases, and Muckel in 18 per cent. Sometimes cysts of the broad ligament are present. Cystic disease of a kidney has occasionally been noted.

Sometimes a concomitant fibromyoma is also found in the wall of a Fallopian tube, or the vagina, or in the substance of the ovary, or in the broad ligament; indeed, they may be present in more than one of these structures in the same case.

Association with Maldevelopments.—A considerable number of cases of fibroid have been reported in association with uterine and vaginal malformations.

Pressure Complications.—Pressure effects are found in a considerable percentage of cases, chiefly in those in which the tumors are situated mainly within the pelvic cavity. These are marked in cases of impaction, adhesions,

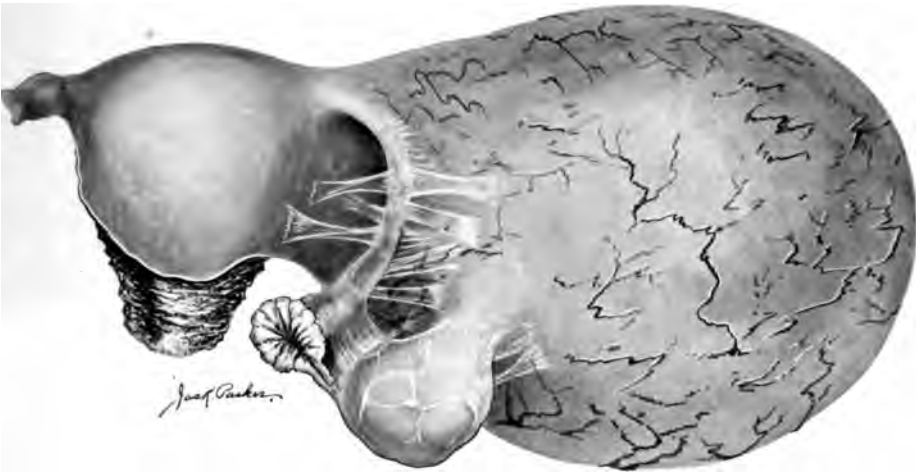


Fig. 306.—Large uterine fibroid developing in the right broad ligament. Tubal and ovarian adhesions are seen.

intraligamentous development; when the growths are associated with pregnancy, or when other enlargements are present, whether inflammatory, hemorrhagic, or neoplastic. As a rule, pressure effects develop only gradually. Sometimes they may develop rapidly, as when a tumor becomes edematous or congested; this is especially noted after torsion of the pedicle of a subperitoneal fibroid. Interference with the bladder is common, frequency of micturition being most commonly produced. The ureter is rarely pressed upon to such an extent as to cause hydronephrosis. Interference with nerves is rare. Occasionally the circulation is impeded, so that there is varicosity or edema in one or both lower extremities, in the rectum, vagina, or vulva.

The ureters, veins, and nerves are very much less frequently directly affected by fibroids than by carcinoma uteri.

Phlebitis is occasionally noted, being usually due to the complication of infection. Thrombosis is favored by a depressed state of health, anemia,

cardiac degeneration, varicosity of pelvic veins, local injury of veins by pressure of a tumor, pregnancy, abortion, labor, operative or examination procedures, and infection.

Pressure on the rectum interfering more or less with defecation is not very common. Hemorrhoids are quite frequent.

Intestinal obstruction is rare. It may be due to strangulation of the bowel by an adhesion, or rarely to the development of a fibroid extraperitoneally, the gut being stretched over the surface of the growth. Temporary obstruction due to accumulation of hard fecal masses above the rectum is occasionally observed, and may produce alarming symptoms.

Changes in Distant Organs.—Cardiovascular symptoms are frequently found. In a series of 210 cases treated surgically by the author they were present in about 25 per cent. This is a smaller percentage than has been recorded by the few writers who have given special consideration to this subject. Strassmann and Lehmann, for example, studied 71 consecutive patients in Gusserow's clinic, and found that there were organic changes or marked functional cardiac disturbances in 40.8 per cent. Fleck made a study of 325 case-records and found a similar percentage; he states that in each instance in which an autopsy was made definite cardiac changes were found, *e. g.*, brown atrophy, fatty degeneration, etc. He believes that the heart changes were not secondary to loss of blood, because out of 133 cases in which there had been no hemorrhage, cardiac changes were present in 34.6 per cent. Roger Williams reports the findings in 22 autopsies in women with myoma uteri as follows:

Valvular disease, mostly chronic.....	6	cases.
Fatty degeneration.....	5	"
Hypertrophy and dilation.....	3	"
Atheroma of aorta.....	3	"
Small heart.....	1	case.
Normal.....	12	cases.

Wilson, of Birmingham, G. B., has recently referred to a series of ten autopsies in the Birmingham General Hospital, and states that the occurrence of myocardial degeneration in four at least among ten women dying as the result of uterine fibromyoma is suggestive that there is some close relationship between the two affections.

He also reports that in 72 cases in which radical surgical interference was indicated there were cardiac disturbances in nearly 46 per cent. They were as follows:

Adherent pericardium.....	1	case.
Valvular disease.....	6	cases.
Myocardial affections.....	14	"
Murmurs, probably hemic.....	12	"

Shoemaker has also very recently directed attention to this subject.

More extended observations are necessary to enable us to speak positively in regard to the influence of uterine fibroids on the cardiovascular apparatus, but that there is an important relationship must be admitted by all who have given any consideration to the subject.

Changes may be induced in various ways. In cases in which chronic anemia results from uterine hemorrhage, defective nutrition may cause

degeneration in the heart and large vessels, while dilation and weakening of the former may be induced. Very large tumors may lead to cardiac changes by interfering with the freedom of heart and lung action, by pressure on the large vessels, by interference with the alimentary functions, nutrition being impaired and toxic matter being absorbed from the bowel, by pressure on the kidneys, ureters, or renal vessels, or reflexly by irritation of the cerebrospinal



Fig. 307.—Fibrocystic tumor of uterus. Removed successfully. Weight of patient, 90 pounds after removal of tumor; weight of tumor removed, 87 pounds. Measurements: External condyle of humerus to tip of acromion, $3\frac{1}{2}$ cm.; tip of olecranon to tip of acromion, $3\frac{1}{2}$ cm.; top of patella to mamma, 73 cm.; anterior superior spine of ilium to tip of acromion, 46 cm.; great trochanter to tip of acromion, 44 cm.

or sympathetic nervous apparatus, especially the large abdominal ganglionic masses belonging to the latter system.

Wilson believes that there is a certain amount of evidence to show that in some cases cardiac hypertrophy may result even when the uterine tumor is only of moderate size, and thinks that this may be due to increased cardiac activity associated with increased vascular requirements.

Another question of considerable interest is that relating to the influence which may be exerted by products of the uterine growth on the heart and other organs through the medium of the circulation. Is it possible that the tumor continually produces some form of internal secretion which may be toxic in character, and in cases of degenerating fibroids, does the disintegration of proteid material produce a poison capable of affecting distant organs?

Fleck has suggested that in many cases in which the ovaries are diseased the heart and other organs may be influenced chiefly through a pathologic internal ovarian secretion. These suggestions, while supported by little more than crude speculations, certainly indicate the direction in which careful investigation should be made, especially by experts in pathologic chemistry.

Renal disturbances are more common in association with uterine fibroids than is generally believed. In about 30 per cent. of my cases there was noted one or more of the following conditions, viz., deficient amount of urine or urea, albumin, casts, edema of the feet. In no instance was there evidence of previous organic renal disease, nor did treatment fail to bring about marked improvement prior to operation. The factors concerned in the production of these renal disturbances are probably identical with those causing the cardiac changes already described. They are chiefly operative in the case of abdominal tumors or of those situated in the pelvis, which completely fill the latter, or develop extraperitoneally or are extensively adherent to the pelvic wall.

Glycosuria or acetonuria is rare as a complication of fibroids. The *blood* frequently becomes impoverished. Large quantities may be lost from the uterus. In the advanced stages of fibroids, gastrointestinal and nervous disturbances are often present. It is believed by many that the mere metabolic products of the tumor exercise a deleterious effect on the system, apart from its other effects.

Mortality of Unoperated Fibroids.—It is impossible to give accurate statistics as to the mortality connected with fibroids, directly or indirectly, since it is difficult to estimate satisfactorily the true frequency of these tumors in women. Winckel states that death results from the effects of the tumor after a longer or shorter period in about 10 per cent. of cases. Noble, referring to a composite series of 1188 cases operated by him and others, estimates that about one-third would have died had operation not been carried out. This writer has done good service in emphasizing the importance of the tumor degenerations and pelvic complications capable of leading to a fatal issue. If it be claimed by some that he has exaggerated their importance, it may be stated, on the other hand, that the majority of observers have underestimated their influence. The widely held views as to the comparative harmlessness of uterine fibroids must be greatly modified. While it is probably true that these growths comparatively rarely directly cause death, it is equally true that the influence exerted by them may frequently be so deleterious as to render the system less able to withstand the attacks of other diseases. In this connection should be remembered the degenerative changes in the heart musculature, liver, and kidneys caused by large fibroids, also the loss of blood and the pressure-effects caused by many growths; indeed, death may in some cases be directly due to these alterations in the structure and function of the heart, vessels, or kidneys. Death may also be due to the great

loss of blood and exhaustion, to interference with the function of the alimentary canal, to infection associated with suppuration, gangrene, peritonitis, phlebitis, or embolism. In connection with pregnancy and labor the mortality-risks due to fibroids are very considerably increased.

SYMPTOMS.

Hemorrhage from the uterus is a very marked symptom in many cases. It occurs as menorrhagia or metrorrhagia, and usually develops gradually, not suddenly, as in the carcinomata. This symptom is found with tumors in the region of the mucosa, which is generally altered by interstitial endometritis in such cases. The worst bleeding occurs when submucous tumors become polypoid. Sometimes hemorrhage is due to ulceration of the mucosa over the tumor; more rarely rupture of veins in the capsule causes it; it may be sudden and even fatal. Death directly from hemorrhage is, however, very rare.

The indirect results of continued hemorrhage, viz., anemia, weakness, cardiac and other degenerations, tendency to thrombosis and embolism, may be very serious.

Subperitoneal fibroids do not necessarily cause any hemorrhage, but it may sometimes occur.

When *cardiac degeneration* has set in, the various symptoms of heart disease may be marked. They are most apt to be met when the tumor is very large, or when there has been much loss of blood.

If *renal degeneration* has occurred, then lessened excretion, albuminuria, and casts, etc., are present.

Leukorrhœa is often noticed, but it is not characteristic. It is most marked when the endometritis is of the glandular type, and is often irregular. Just before and after menstruation there is usually a somewhat profuse mucous discharge. The discharge is foul smelling when ulceration or gangrene occurs.

Pains are common. They may be only of a heavy, dull, dragging nature, with reflex abdominal and lumbar distress. In many cases these are felt first at the time of the menstrual periods.

With subperitoneal fibroids there may be pain due to peritonitis, to torsion, to pressure in the abdomen due to their large size, or to their falling into the pelvis and there causing pressure or becoming impacted.

The association of pain with degenerative changes must be noted. Fairbairn has lately noted this particularly in studying a series of tumors in which necrobiosis had occurred. In such cases the mass may even be tender to pressure, though no actual inflammation exists. Cullingworth noted pain as a marked symptom in two-thirds of his necrobiotic fibroid cases, in three-fifths of his cystic, and in one-third of the edematous fibroid cases.

In some cases pain may be due to axial torsion of the uterus itself, and may be sudden and severe, or slowly produced and moderate.

Dysmenorrhœa may be very intense. These pains may be like those of labor in the case of the submucous polyp, owing to the efforts of the uterus to expel the tumor congested by the menstrual period. It may also be very intense if an interstitial or a prolapsed peritoneal tumor fills the pelvis; the suffering is due to the swelling which the tumor undergoes. In many cases

there are pains extending downward into the legs. (Often, however, the suffering is due to an associated tubal or ovarian inflammation.) Sometimes the pains may be of a colicky nature, and are relieved by change of posture.

Reflex gastric disturbances may be present.

Pressure symptoms are common. Interference with the bladder may cause painful, difficult, or frequent micturition or perhaps retention. In some cases these troubles are more aggravated at the menstrual periods or may be present only then. Very small tumors as well as large ones may cause these disturbances. In the rare instances in which the ureters are compressed, leading to hydronephrosis, symptoms of the latter condition may be more or less distinct. The urinary tract may become infected, causing cystitis, ureteritis, pyelitis, or pyelonephritis in turn.

Pressure on the rectum may lead to constipation or difficulty in defecation, which may be periodic or irregular; occasionally diarrhea is present, and sometimes even tenesmus, while interference with the venous circulation often causes hemorrhoids. Varicose veins and edema may occur in one, less often in both, lower extremities, or even phlebitis and thrombosis (phlegmasia) may develop, and sometimes there may be visible enlargement of the superficial abdominal veins. Various nerves may be affected, causing weakness, numbness, pain, or aching, *e. g.*, the sciatic, obturator, or anterior crural; these are frequently worse during menstruation. When infection occurs in fibroids, the usual local and general symptoms associated with sepsis are found, varying in character in different cases.

PHYSICAL SIGNS.

Small submucous tumors above the level of the cervix, which are pedunculated, may be felt when the canal is dilated sufficiently to admit a finger. When they project through the cervix, they are red in color if still covered with the uterine mucosa, but if the mucosa has disappeared, they are usually pale in color. Covered with mucosa they are sensitive to pain; when uncovered they are not sensitive. Sometimes such a tumor, protruding through the cervix may be in a condition of ulceration or gangrene, rendering the diagnosis of fibroid difficult from that of a malignant tumor.

The whole uterus is increased in size with these tumors. *Small submucous* nonpedunculated tumors may be very difficult to diagnose, because the uterus is increased in size and more rounded, though the tumor may be appreciable bimanually, especially on dilating the cervix, as the exploring finger may feel the projection, covered with its soft mucosa, encroaching on the lumen of the uterus. As these tumors enlarge they tend to dilate the cervix and to project through it into the vagina.

Small interstitial tumors may easily escape notice, though some enlargement of the uterus, usually irregular, may be appreciable and the nodule or nodules may be more or less easily felt, according to their size. The higher in the uterus they are situated, the more apt are they to be missed. When situated low in the uterus, they may bulge down into the cervix and be mistaken for inversion. Nodules are smooth and defined in outline. *Small subperitoneal tumors* are felt as slight bulgings of the surface or as distinct projections, sessile or pedunculated. The latter are more or less movable and are smooth and hard unless they are cystic, when they have an elastic consistence.

A *cervical fibroid* may be felt as a polyp projecting from the cervix, smooth and elastic. Close to it may be felt the os. The opposite lip may be somewhat thinned. Sometimes they may grow as polyps into the canal of the cervix. When they develop in the upper portion of the cervix, they may be felt developing extraperitoneally in one or more directions.

The large polypoid forms must be differentiated from polyps of the interior of the uterus and from inversion of the uterus. Those growing from the upper part of the cervix and extending into surrounding tissues may be mistaken for sarcoma.

When the tumor is large. A large tumor may be either regularly or irregularly rounded, or, indeed, very irregular in outline. It can usually be distinctly defined. If the tumor be subperitoneal, its connection with the uterus may frequently be made out (though this may sometimes be impossible). The uterus may be felt elongated and elevated, and the sound be passed to an abnormal length. These tumors vary in their range of movement according to their size, the length of their pedicle, and the adhesions present. The uterus is displaced in various directions, but may not be much enlarged.

When the tumor is interstitial, the uterus becomes part of the mass, which usually lies more or less mesially, though it may be developed more in one half of the abdomen than in the other. When it grows into the broad ligament, it has the relations of a broad-ligament tumor (*vide* p. 293).

A soft myoma may on palpation give the feeling of a cystic tumor.

It may be elastic or even obscurely fluctuant.

The percussion-note over the tumor is dull, unless it be covered with gas-containing intestines. There is usually tympanitic resonance in the flanks, unless the colon contains feces or there be ascitic fluid in the abdomen, or unless there be a part of the uterine tumor growing into the region of the loins (or some other mass). On changing the position of the patient, the percussion signs do not change in outline as in ascites, unless the subperitoneal tumor is very mobile or ascites be present also with the tumor.

A uterine soufflé is generally heard over the broad ligaments, and may be distinguished for a short distance on to the tumor. In very vascular fibroids it may even be heard over the greater part of the tumor, and in certain cases occasionally a thrill may be felt.

The uterine cavity is enlarged. Owing to the displacement of the organ it is sometimes impossible to pass a metal sound, but a gum-elastic catheter or bougie may often be introduced the entire distance to the fundus when the ordinary sound fails.

The cervix may be markedly displaced upward, downward, or laterally. The vagina may be drawn up, displaced laterally, or pushed downward. There is no pain on palpating fibroids or on moving them unless there be some associated inflammation near or over the site of the tumor.

DIFFERENTIAL DIAGNOSIS.

Small interstitial and submucous fibroids cause changes in the size and shape of the uterus which must be distinguished from the following: chronic metritis; ante flexion and retro flexion; malignant diseases of the uterus; inversion of the uterus.

The uterine enlargement is occasionally mistaken for a uterus of normal

shape enlarged by metritis. In the latter condition the enlargement and its consistence are uniform. When a fibroid is present, the uterus is usually asymmetric and the portion containing the tumor is of harder consistency than the rest of the uterus, and on careful examination the outline of the fibroid can generally be distinguished. An asymmetric metritic uterus may more readily be mistaken for the fibroid uterus, but no nodule can be felt in it.

More frequently the small myomatous uterus may be mistaken for a pregnant uterus. The consistence of the former does not, however, change

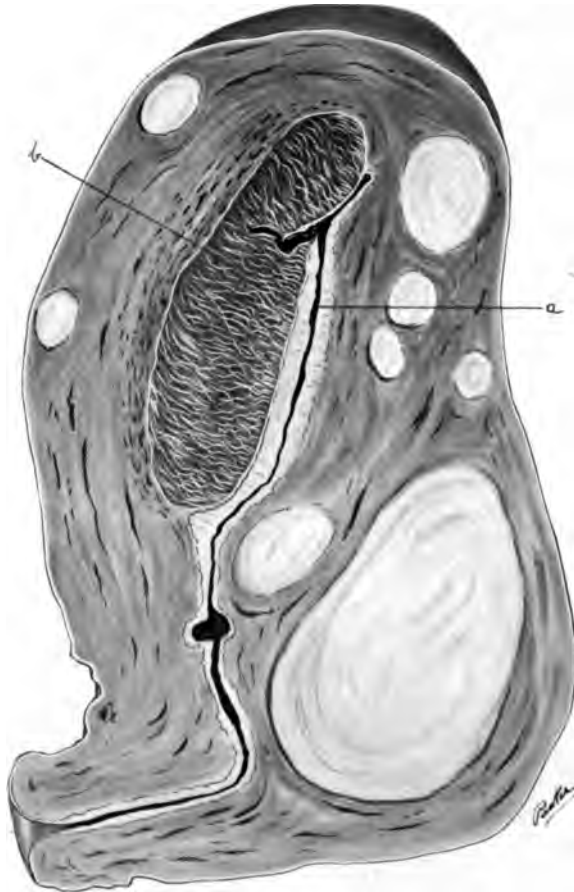


Fig. 308.—Fibroid uterus containing placenta. The specimen was obtained from a patient on whom Porro-Cesarean section was performed: *a*, Uterine cavity; *b*, placenta.

from time to time; there is no softening of the cervix; amenorrhea is not present. In cases of doubt examination should be repeated at monthly intervals. The pregnant uterus increases in size more rapidly, while a slow-growing myomatous uterus remains practically the same.

An early pregnant uterus is firmer than normal as the result of an old metritis may not appreciably vary in consistency, and may more closely simu-

late a fibroid uterus, especially if hemorrhages occur. One case of early pregnancy is known to the author in which there was a reflexal placenta prævia which caused frequent irregular hemorrhages, simulating a fibroid very closely; a large firm blood-clot formed within the uterus and increased the difficulty of diagnosis.

A small fibroid growing on the upper anterior wall of the uterus may sometimes lead to a diagnosis of antelexion. On careful bimanual examination, however, the fundus may be found above the tumor. When there is no sulcus between them, a sound introduced into the uterus may indicate the true position of the fundus.

Similarly a fibroid of the posterior uterine wall felt through the posterior vaginal fornix or per rectum may be mistaken for a retroflexion. Careful bimanual exploration and the use of the sound usually suffice to determine the true condition. Sometimes such a growth may exist along with a retroversion.

It may, in certain cases, be difficult to distinguish malignant uterine disease from myoma. When a submucous fibroid descends to the cervix and undergoes sloughing or ulceration, cervical carcinoma may be simulated, there being loss of blood and a foul-smelling discharge. If the tumor be tightly grasped by the cervix or be adherent to it, the resemblance may be very marked. If such conditions exist, it is necessary to remove a portion of the tissue for microscopic examination before a diagnosis can be fully established.

In cases when there is no sloughing or ulceration and the fibroid is situated in the body, the suspicion of sarcoma or carcinoma arises chiefly from the loss of blood.

In the early stages hemorrhage in connection with myoma is usually confined to the menstrual periods; but in malignant disease it is usually irregular.

Sudden flooding is much more frequent in malignant disease than in myoma. Indeed, when it occurs with the latter, concomitant pregnancy and abortion may usually be suspected. Foul-smelling discharge is common in malignant disease and rare in myoma, being usually found only with the sloughing fibroid tumors.

It is usually easy to decide as to the presence of carcinoma of the cervix by examination of the tissues, both within and also external to the os externum. It is more difficult to decide as to malignancy of the corpus. The detection of one or more well-defined rounded nodules on careful bimanual examination is suggestive of myoma. In the case of fibrosarcoma the nodules may not be so well rounded or sharply defined. In cases of doubt the uterus must be cureted and the diagnosis established by means of the microscope.

Sarcoma associated with myoma cannot be diagnosed in the early stage unless portions of the endometrium be removed by curetage and examined microscopically. It may, however, be impossible to reach the malignant area with the curet. Frequently, the condition is discovered only after metastases have developed or when the uterus is examined after removal.

When a submucous fibroid descends to the cervix, it may sometimes be mistaken for an inverted fundus of the uterus (*vide* p. 500).

Small subperitoneal fibroids must be diagnosed from—ovarian and tubal

enlargements; broad-ligament cysts and exudates and intrapelvic exudates; displaced kidney or spleen.

Ovarian and tubal inflammatory enlargements may be mistaken for subperitoneal fibroids, especially when they are adherent to the uterus. Usually the diagnosis may be confirmed by the history of an inflammatory attack, by the tenderness on palpation, and by the fixation; they are rarely as hard or well defined as fibroid tumors. Occasionally, it is very difficult to distinguish between them by bimanual examination alone. When the ovary or tube is distended with blood and in close relationship to the uterus, it may be mistaken for a fibroid. Frequently there may be a history of rapid development.

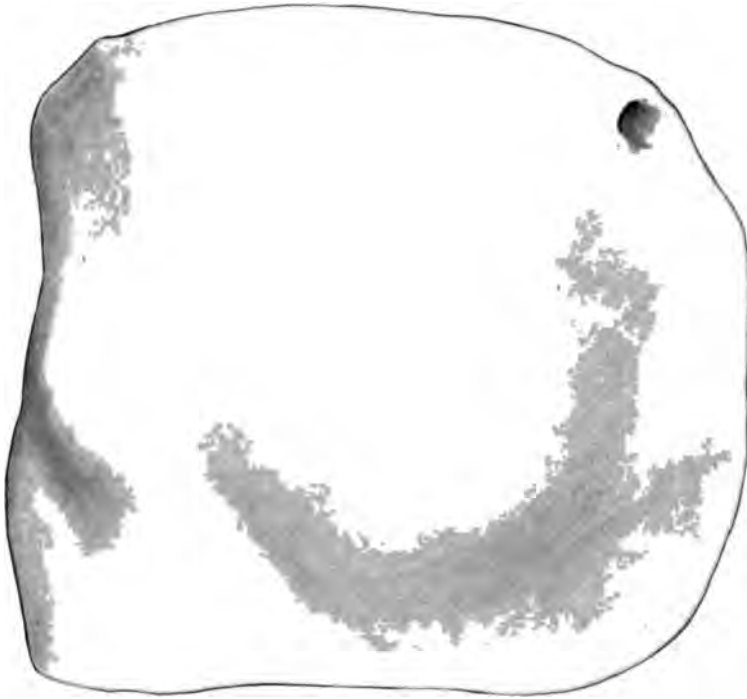


Fig. 309.—From drawing of a cast of the abdominal wall presenting a swelling above Poupert's ligament on the right side. The swelling was caused by the enlarged spleen, which lay in the right side of the pelvis, adherent to the right appendages and other pelvic structures. The case was sent to the author as one of uterine fibroid.

which is not usual in the case of fibroids, but if there be no such history, it may be impossible to distinguish their true character unless exploratory puncture or, better, exploratory laparotomy is performed.

In cases of multiple subperitoneal fibroids, some of them may very closely resemble ovarian or tubal enlargements; and when both the fibroids and the adnexal lesions are present in the same case, it may be impossible to differentiate between them.

New-growths of the ovary may be mistaken for fibroids under various conditions. When they are small, they can be made out to be distinct from

the uterus unless the ovary happens to be adherent to the latter. When larger, they are more apt to be mistaken for myomata if very tense, or are adherent in the pelvis or are intraligamentous, but ovarian tumors grow more rapidly than fibroids and, excepting solid growths, are rarely so firm and do not cause menorrhagia and metrorrhagia.

A pelvic peritonitic or cellulitic exudate may simulate a fibroid. Either is usually distinguishable from the latter by a history of inflammation, rapid development, and pain. On examination, the exudate may be as hard as a fibroid, yet is not round or circumscribed and is immovable.

A pelvic hematocoele or hematoma may be mistaken for a fibroid, yet the history aids the differentiation, viz., suddenness of onset and rapid formation, usually accompanied by signs of shock, and its consistency, soft at first, afterward firm. It is not movable, has not the sharply outlined contour of a fibroid, and yet tends to diminish in size gradually after hardening has occurred in it. An accumulation of blood in the malformed horn of a bicornute uterus may cause it to appear very like an irregular fibroid. In such a case, however, there is usually a history of periodic attacks of pain.

Infrequently a displaced kidney or spleen may lie in close relationship to the uterus and may be mistaken for a fibroid. This error is most apt to be made if adhesions exist. When the displaced organ is movable, careful examination usually reveals its freedom from the uterus. On successive examinations the former may be felt in different portions of the abdomen and it can often be replaced in its normal position if adhesions are not present. Such displacements are frequently associated with attacks of severe abdominal pain caused by twisting of the elongated pedicle.

Fibroids of the cervix vary considerably in their relationships. A small tumor may be felt as a distinct swelling in the cervical wall, which it may cause to bulge inward, outward, or downward.

(a) Situated in the upper portion of the cervix, it tends to press the canal to the opposite side and to distort its shape; sometimes it may so occlude its lumen that discharges cannot escape. The rest of the cervical wall may be thinned and stretched over the tumor. The tumor may also extend into the parauterine tissues.

(b) When the fibroid develops in the lower portion of the cervix, it tends to grow into the canal or into the vagina, and as it increases it usually becomes elongated in the direction of the latter passage. Ulceration and necrosis are frequent. Those polypoid growths must be distinguished from fibroids growing from the interior of the corpus and from inversion of the uterus. Nonpolypoid forms are most apt to be mistaken for sarcomata.

Large tumors must be diagnosed from the following conditions:

1. Advanced uterogestation.
2. Ovarian and broad-ligament, cystic, and solid tumors.
3. Ectopic gestation.
4. Hematoma and hematocoele.
5. Inflammatory collections.
6. Cystic uterine tumors.
7. Desmoid tumor of abdominal wall.

A large, round, myomatous uterus extending into the abdomen may simulate the pregnant uterus. When the tumor is soft, the semifluctuant

feeling may resemble that obtained on palpating the pregnant uterus in the interval between relaxation and hardening. While such a tumor may vary in consistence, it does not exhibit the systematic intermittent variations of the pregnant uterus. The souffle associated with a fibroid may exactly resemble that of pregnancy. The transmission of the cardiac beat from the aorta may be mistaken for the fetal heart, but is synchronous with the patient's pulse, while fetal heart-sounds, differing in rhythm from the maternal pulse, are absent. When there are several fibroids, they may simulate fetal parts. The pregnant uterus grows more rapidly than a fibroid, and the cervix is soft in the former and hard in the latter.

Uterine pregnancy is almost always accompanied with amenorrhea for several months; a fibroid tumor does not cause cessation, but rather increase of menstruation or metrorrhagia. Fetal movements are naturally absent in a fibroid, though sometimes a freely movable, pedunculated subperitoneal tumor may simulate a fetal movement and be mistaken for it by the woman. In all cases of doubt time should be allowed to establish a diagnosis. The pregnant uterus increases in size appreciably in a month; the fibroid uterus does not enlarge unless there be hemorrhage in it or some rapid degeneration.

A large ovarian cyst may sometimes be distinguished with difficulty from a fibroid. The former usually grows more rapidly and is not accompanied, as a rule, with menorrhagia or metrorrhagia. When the cyst has small loculi filled with gelatinous material, it may feel solid on palpation and may closely simulate a soft myoma. When there is a large cyst next the abdominal wall, fluctuation may usually be felt.

The health is generally disturbed at an earlier period in the case of ovarian tumors than in fibroids, except when there is marked hemorrhage with the latter. With large cysts the "ovarian facies" usually develops; with fibroids it is rare. Again, the abdominal veins are frequently enlarged with ovarian cysts, rarely with fibroids.

Large fibrocystic uterine tumors may sometimes simulate an ovarian cyst so closely as not to be distinguished from it by physical examination (*vide* p. 394).

Ectopic gestation may sometimes be mistaken for a uterine fibroid or the latter for the former. The hardness of the fibroid, its slow growth, and the absence of the signs and symptoms of pregnancy usually suffice to easily establish its nature, especially in the case of a subperitoneal tumor. The interstitial soft myoma or a fibrocystic tumor, however, may simulate an interstitial ectopic pregnancy as regards the shape of the uterus, and the resemblance may be still further increased when there are irregular discharges of blood from the uterine cavity, but the absence of the signs and symptoms of pregnancy here also makes the diagnosis easy in most cases.

When the uterus is greatly enlarged by fibroids there may be much resemblance to an advanced ectopic gestation in which the fetus has died and absorption of the liquor amnii has taken place, but the history of the case should greatly help to distinguish between them. The author once had charge of a woman with a fibroid uterus who was seized with acute pains following several days of constipation. The fecal accumulation simulated a tubal gestation in which hemorrhage had occurred, especially as the pains occurred after a period of amenorrhea, and colostrum was present in the

breasts. The true nature of the case was made evident after a copious evacuation of the bowels.

Hematoma, hematocele, and inflammatory collections may simulate large fibroids. The differential diagnosis has been considered in connection with small tumors (*vide* p. 530).

Fibrocystic uterine tumors may not be distinguished from fibroids unless the cystic collections be large and the cyst-wall thin. In such a condition distinct fluctuation may sometimes be obtained. A very soft myoma may, however, simulate a cystic mass very closely.

A desmoid tumor or fibroma of the abdominal wall may sometimes simulate a fibroid. The former swelling usually projects under the skin and may be grasped; it is, however, usually immovable.

TREATMENT.

MEDICINAL TREATMENT.

At the present time medicines play a very small rôle in the treatment of fibroids. There is no drug which can bring about absorption of such tumors or prevent their growth. In past years ergot has been widely used to effect these results, but experience has shown that it is ineffective. By many it has been employed because of its influence on the uterine musculature, in order that interstitial tumors might be forced inward or outward and so become submucous or subperitoneal; it was considered as particularly valuable in promoting the expulsion of the growth from the uterine cavity. At the present day the use of the drug for such purposes would be universally condemned. A subperitoneal fibroid may sometimes cause as much trouble, *e. g.*, from pressure or torsion, as may an interstitial growth, while the risks attendant upon the expulsion of a submucous tumor, *viz.*, hemorrhage, necrosis, ulceration, and infection, are so great that such a process should not be allowed to continue after it has been recognized. The only purpose for which ergot may be used is to diminish the loss of blood from the uterine mucosa during or between menstrual periods. The drug undoubtedly causes contraction in the small arteries of the uterus and so may exercise a valuable hemostatic action in many cases of bleeding. Its influence in this direction varies considerably. These variations are mainly due to the condition of the uterine mucosa and to the nature of the preparation of ergot. When the capillaries of the mucosa are much dilated so as to form small sinuses, or when there is marked enlargement of the veins of the uterus and broad ligaments, the drug causes little or no diminution in the hemorrhage. Marckwald and Helme have experimentally studied the variations in the actions of ergotin and have shown that they depend upon the relative proportions of its chief constituents, *viz.*, ergotinin and sclerotinic acid. The former is not a hemostatic, but increases the rapidity of the blood-flow; the latter causes contraction of the arteries and so diminishes the blood-flow. Unfortunately, sclerotinic acid alone has not been very much employed. Solutions of ergotin or fluidextract of ergot tend to become altered and worthless.

Prolonged use of the drug weakens its influence, and larger doses are required, which latter are apt to cause disturbed digestion, irregular heart action, mental depression, and general impairment of health.

Hydrastis canadensis has been greatly praised by several authors. It is,

however, of no value in promoting absorption of a fibroid, and is no more certain as a hemostatic than ergot. Red hawthorn, gallic acid, peracetate of iron, and acetate of lead have also been used, but are of little value. Iodin, iodid of potassium, and the mercury salts have been employed to cause absorption of the growths, but are ineffective. The bromids have been tried, but their only value is to produce a sedative action in cases where the tumors are associated with pain or discomfort. Other sedatives, *e. g.*, morphin, codcin, etc., may also be necessary to relieve pain. Various spas have been lauded as possessing special virtues in the treatment of fibroids, *e. g.*, Kreuznach, Schwalbach, Woodhall. The extravagant claims made by some physicians connected with such institutions are entirely unwarranted, even though many patients improve in general health under the regimen of a spa, especially when buoyed up by strong anticipations of recovery or improvement. The influence of a body-bath of bromated or iodated water must be considered as entirely fanciful.

Various gland extracts have been the fashion in late years. Thyroid extract and iodothylin have been used, presumably because they may lead to a reduction in the body-weight, stimulating tissue-metabolism and increasing the excretion of urea, but they entirely fail, however, to bring about absorption of the tumors. Mammary extract has also been tried, but is of no value in altering the growths.

Adrenalin has a hemostatic effect in uterine hemorrhage, but its influence is very temporary. The same is to be said of gelatin solution. In conclusion it should be stated that medicines are only to be employed in the treatment of fibroid tumors to diminish hemorrhage, to relieve pain, and to improve the blood and general health. In the great majority of cases they are needed to check bleeding and to improve the anemic state. Preparations of ergot and iron are, generally speaking, the most reliable for these purposes. In some hemorrhagic cases the patient can be kept in a fairly good state of health, but in others the loss of blood cannot be controlled. Frequently the system is much disturbed by the medicines used to give relief.

GENERAL AND DIETETIC TREATMENT.

It has long been recommended that a woman with a rapidly growing fibroid should be placed on a simple, nonstimulating diet, alcoholics being avoided. However valuable this advice may be on general principles, it has but little influence on the development of a fibroid.

When a patient complains of pelvic pressure symptoms, special attention must be given to the regulation of the bowels; she should also refrain from long standing or walking and from hard work, and should lie down for an hour or more each day. During the menstrual periods she should remain in bed most of the time. Occasionally, when tumors of moderate size cause bearing-down or dragging sensations in the pelvis, a Hodge or ring pessary may give some relief by supporting the uterus. When a large abdominal growth causes pendulousness, a strong abdominal binder may give some support.

ELECTRIC TREATMENT.

During the nineteenth century various attempts were made to employ electricity in the treatment of fibroids.

Sir James Simpson, Tait, Althaus in England, Kimball and Cutter in America had tried it previous to 1886, but with no success. In that year Apostoli, of Paris, presented reports of his success with the galvanic current, and immediately afterward many British and American authorities gave his method an extensive trial. Foremost among these was Thomas Keith, of Edinburgh, then noted as the most successful hysterectomist of his time.

The results of these trials have led to an almost universal abandonment of this method of treatment, as the extravagant claims of Apostoli and his followers were not verified. It has been abundantly demonstrated that the electric current cannot appreciably alter subperitoneal or fibrocystic tumors. The positive pole may frequently exercise a hemostatic influence on the uterine mucosa, though occasionally it fails to do so. Moreover, this influence is probably only that which any cauterizing agent freely applied might bring about.

The use of the negative pole within the uterus may somewhat diminish the size of interstitial and submucous growths, but it is rare to find a marked or continued diminution, and extremely uncommon to note complete disappearance. Most cases in which a tumor is said to have disappeared are those in which there has been a mistake in diagnosis, the swelling having been probably inflammatory or hemorrhagic.

The puncture of a fibroid is dangerous and apt to lead to infection; the risk of this is increased by the number of applications recommended during a course of treatment. In the presence of tubal or ovarian disease electricity is very apt to cause an exacerbation of the trouble, and this may be accompanied with more or less severe peritonitis.

It has been frequently noted that the general health of the patient appears to improve during the applications of electricity. This is partly due, in hemorrhagic cases, to the diminution in the loss of blood, but there is little doubt that much of the effect is purely suggestive, the laity being generally impressed by the magic of electricity in treatment, especially if they believe that it may cause a tumor to disappear. In endeavoring to estimate the true place of galvanic electricity in the treatment of uterine fibroids it may be said that it may be used for the hemostatic action of the positive pole in those cases where there is hemorrhage, and where no contraindication exists, should hemostasis not be obtainable by drugs, provided surgical measures cannot be carried out by an expert operator.

(The nature of the apparatus employed and the methods of application are described on p. 203.)

SURGICAL TREATMENT.

In recent years the surgical treatment of fibroids has gradually displaced all other methods in the hands of the majority of experienced gynecologists. Owing to the improvements in technic and to the careful preparation of patients excellent results have been obtained and the mortality from operative procedures very greatly reduced. There are differences of opinion as to the frequency with which surgical treatment should be carried out, but the tendency at present is undoubtedly to extend the sphere of its employment. The custom, so long prevalent in the profession, of encouraging women with fibroids to be patient and to wait in the hope that the menopause may bring them relief has been responsible for much unnecessary morbidity and pre-

mature death. Occasionally, such advice may have a satisfactory issue, but in the light of our present knowledge and of our ability to remove tumors surgically with a minimum of danger to life, to apply it indiscriminately to fibroids in general is indefensible.

It is very difficult, however, to describe absolute indications for the guidance of those who are able to carry out surgical measures. There are some who hold that all fibroids should be removed unless there is some marked contraindication to operative procedures. This attitude is considered as too extreme by the majority of gynecologists at the present time. A nearer approximation to the opinion of the latter would be the statement that all large or growing tumors should be removed as well as the small ones which cause troublesome or serious symptoms. With regard to the uterus itself, some writers are extremely conservative and urge that as much of the body should be left after the removal of tumors as is possible; others again are more radical and very frequently remove the body of the uterus or even the entire organ, together with the tumor. In attempting to establish indications for surgical treatment various factors must be considered. Sometimes one of these, sometimes several, may determine the procedure.

Thus, the *site of the growth* may indicate early removal of the tumor, *e. g.*, a submucous polypoid fibroid, a cervical growth, one developing extraperitoneally, a subperitoneal tumor tending to descend into the true pelvis, etc.

The *nature and condition of the tumor* may be the indication, *e. g.*, a soft interstitial myoma, a cystic fibroid, a necrosed or infected growth, one growing rapidly, malignancy, pregnancy.

The *nature of the symptoms* may suffice, *e. g.*, excessive or long-continued loss of blood, pressure on bladder, bowel, blood-vessels, ureters, etc., sterility, abortions.

The *size and number of the tumors* within a somewhat ill-defined limit are considered by many authorities as secondary to the other factors in determining surgical interference. Thus, for example, a very small growth in one position may cause a marked disturbance of the function of the bladder, whereas a larger growth at a higher level might not cause any symptoms whatever; or one or two small *submucous* growths might be associated with extreme loss of blood, whereas a subperitoneal tumor four or five inches in diameter might perhaps never cause any trouble; or, again, a small pedunculated subperitoneal growth, by falling below the pelvic brim, might cause serious pressure disturbances which would not have arisen had it remained above the pelvic brim.

Fibroids should never be allowed to reach a large size, *i. e.*, to become palpable abdominal swellings, because of the tendency to degeneration in the heart, liver, and kidneys, conditions which seriously add to the risk of operative procedures. No definite relationship can, however, be established between the size of fibroids and the commencement of degeneration; many variations are found. Removal of the largest growths should be undertaken only after thorough preparatory measures have been adopted to improve the whole system, especially the action of the heart, kidneys, skin, and bowels.

The Nature of Associated Pelvic Complications.—In a considerable percentage of cases, interference may be indicated on account of an associated disease not in the uterus itself, *e. g.*, tubal, ovarian disease, adhesions, etc. That these complications are far more frequent than is generally supposed is

evident from recent investigations of Cullingworth, Noble, Frederick, Scharlieb, and others. Thus Noble, in his series of 258 cases, noted 163 associated pathologic changes in the uterus and other viscera; Scharlieb, in 100 cases, noted 77; Frederick, in 125, noted 109; the author, in 210 cases, noted 164.

In the past ultraconservative writers have, to a great extent, ignored such complications in their consideration of the fibroid disease. In a very considerable percentage of such cases these complications cause more or less interference with health, and may cause death. In 688 cases of fibromyomata in the hands of four operators, Noble estimates the presumptive mortality (leaving out mortality from degenerations and complications in the uterus alone) as follows: Martin, 16 per cent.; Noble, 16 per cent.; Frederick, 23 per cent.; Cullingworth, 24 per cent. Including complications outside the uterus, the presumptive mortality is higher. Noble believes that the early operation in fibroid will effect a saving of from 25 to 30 per cent. in mortality, as well as a great reduction in morbidity.

The surgical procedures* employed at the present time in the treatment of fibroid tumors may be considered in three divisions:

- A. Those which diminish the blood-supply.
- B. Those which remove the tumor alone.
- C. Those which remove the tumor with a part or with the entire uterus.

A. Methods which Diminish the Blood-supply.

- 1. Removal of the uterine appendages, accompanied with ligation of the ovarian vessels.
- 2. Ligation of the uterine vessels—
 - (a) By the vaginal route.
 - (b) By the abdominal route.

1. Removal of the Uterine Appendages.—This procedure, known as Tait's operation, has been widely practised during the last twenty years. It was first performed by Lawson Tait, of England, in 1872, for the purpose of checking hemorrhage from a bleeding fibroid. In 1876 Trenholme, of Montreal, and Hegar, of Freiburg, directed attention to the operation and shortly afterward it had become an established procedure in Europe and America.

Value of the Operation.—In a large percentage of cases removal of the appendages is followed by checking of hemorrhage, cessation of growth, and even shrinkage in size of the tumor. Frequently, however, the bleeding may not cease, or, having ceased for a time, may begin anew. The tumor may not shrink, its pressure-effects may not be relieved, or it may even continue to grow. While in some cases the beneficial results follow soon after the operation, in others they may be delayed many months, sometimes one or two years. In fibroids developing after the menopause, in pedunculated subperitoneal growths, and in those with cystic and other degenerations removal of the appendages has been demonstrated to be worthless.

Moreover, in cases of interstitial fibroids in which the operation might be tried it may be impossible to remove the tube and ovary of one side, owing

*Curettage has been recommended as a means of checking excessive hemorrhage, but it is very unreliable. Occasionally it may be followed by some improvement, but not by permanent benefit. When the uterus is much enlarged or the cavity distorted, complete removal of the mucosa is usually impossible. Sometimes the operation may cause profuse flooding, which can be controlled only by firm tamponade of the uterine cavity.

to their displacement, due to an asymmetric development, rotation of the tumor, or to associated inflammatory changes. Sometimes a tube and ovary may be so flattened and buried under the tumor or in a sulcus between two growths or in adhesions as not to be visible or even palpable without great disturbance of the parts. Attempts to reach appendages in such cases may be very dangerous. For these reasons and because of the great reduction in the mortality associated with myomectomy, supravaginal and total extirpation of the myomatous uterus in the hands of skilled operators in recent years, Tait's operation has been almost entirely abandoned. Indeed, at the present time it is doubtful if it should ever be employed except in the rare cases in which the other operations are impossible or inadvisable on account of the patient's general condition. The practice of removing the ovaries and retaining the tumor has gradually been displaced by a procedure which removes the new-growth and conserves the ovaries (or as much of the latter as is normal).

Rationale of the Operation.—By many the efficacy of the operation is believed to be due to removal of the ovaries, by which the artificial menopause is induced, since it is frequently noticed that the natural climacteric is followed by cessation of bleeding and diminution in the size of fibroids. Others think that the most important factor is the ligation of the ovarian arteries, which lessens the blood-supply to the uterus. The truth is, without doubt, to be partly found in both of these explanations. The lessening of the blood-supply as a factor has been demonstrated in cases in which the ovaries have not been removed, but in which one or both ovarian arteries only were ligated.

Technic.—In a simple uncomplicated case the method of removing the appendages is the same as in salpingo-oophorectomy for inflammatory disease by abdominal section.

If the appendages are not easily accessible, owing to complications which have already been mentioned, removal may be very difficult or impossible. It may be necessary to remove many adhesions, much hemorrhage being caused. As the veins of the broad ligament may be much enlarged, they may easily be torn or cut and the bleeding vessels may be secured with difficulty.

2. Ligation of the Uterine Vessels.—This procedure was first advocated by Franklin Martin, of Chicago, in 1893, and later by Goelet, Gottschalk, Hartmann and Fredet, and Altucheff. It has been recommended chiefly in the case of interstitial tumors, Gottschalk limiting the operation to cases in which the growth is not larger than an orange.

The results of the procedure are variable. In some cases temporary improvement only has been noted as regards hemorrhage; in a few instances permanent benefit, menstruation being sometimes suppressed. Occasionally pains have diminished, but frequently they have continued with even greater intensity. In many instances necrosis of the tumor has occurred, causing profuse discharge from the uterus, and in several cases septic infection has occurred, leading to a fatal issue. On account of these unsatisfactory results the operation has been largely abandoned.

Technic.—The arteries have been ligated by both the vaginal and abdominal routes. The latter should be chosen only when the operation is impossible by the former, *e. g.*, when the cervix is markedly elevated.

(a) By the Vaginal Route.—Lithotomy position. Vagina opened by

retractors. Cervix pulled down and steadied by a volsellum and curetage first performed. A circular incision is made through the mucosa covering the upper part of the vaginal portion of the cervix, and extending on each side into the lateral fornix for half an inch. The muscular wall of the cervix is thus exposed. The fornix is stripped upward with the bladder toward the level of the os internum. With a blunt director the main trunk of the uterine artery should be isolated and ligated with catgut. Where it is impossible to do this or where a vein may be injured, a mass-ligature should be passed around the vessels on each side close to the cervix and tied. The mucosal flap is then restored to its position and sutured.

(b) By the Abdominal Route.—Trendelenburg posture. Mesial incision. The round ligament should be pulled forward and an incision made through the anterior peritoneal layer of the broad ligament immediately above and parallel to it. A blunt dissection is then made deeply until the uterine artery is found and ligated. Care must be taken not to include the ureter.

B. Myomectomy—Removal of the Tumor Only.

General Considerations.—This operation has long been recognized as suitable to the majority of pedunculated submucous fibroids, especially those reaching as low as the cervical canal or projecting through it. Its applicability to subperitoneal and interstitial growths has also been clearly demonstrated in recent years, though there are great variations in the extent to which it has been employed in such cases in the practice of leading operators. The writer inclines to the opinion that, owing to the brilliant results obtained in the reduction of the death-rate following total extirpation and supravaginal amputation of the uterus, there has been a tendency in this country to perform these operations in an unduly large percentage of cases, myomectomy having been gradually relegated to a position of very minor importance. In attempting, however, to give specific indications for the performance of this operation, it is impossible to be precise and definite. The size of the fibroid uterus is an important element. I do not believe that myomectomy is advisable when there is a visible or palpable abdominal swelling composed of many small or medium-sized tumors or of one or more large ones, except possibly when there is a pedunculated growth with a small area of attachment to the uterus in a woman under thirty-five. Frequently, however, the operation does not come into consideration even where the swelling does not extend much above the pelvic brim, *e. g.*, when it is composed of a very large number of small tumors.

Age is a factor which must be considered. Thus one might think of the possibility of performing myomectomy in a woman in the neighborhood of thirty years of age, whereas under similar conditions in one over forty one would scarcely consider it at all.

A woman's desire to become pregnant may influence an operator to undertake myomectomy even in certain cases in which he might not be inclined to perform it. The occasional occurrence of pregnancy after this procedure is certainly encouraging. I have had two cases in which sterility ceased after the performance of multiple myomectomy, six small fibroids being removed from one and thirteen from the other. I would not advocate the operation

for this purpose in a case where the body of the uterus would require to be considerably reduced in size or greatly mutilated.

A myomectomy which involves the establishment of a communication between the peritoneal and uterine cavities during the performance of the operation should never be carried out if there is any doubt as to the sterility of the uterine cavity.

It is rarely indicated in cases in which the fibroid condition is accompanied by adnexal disease of such extent as to warrant bilateral salpingo-oöphorectomy. Here it is usually advisable to carry out one of the major operations.

Where cystic or other degenerations exist in the fibroids, myomectomy should not be performed, except possibly in the case of a single large tumor in which the degeneration is nonmalignant.

As regards the selection of the abdominal or vaginal route in the performance of myomectomy, cervical fibroids and pedunculated submucous tumors growing from the body are removed per vaginam. The great majority of interstitial and subperitoneal tumors of the body should be excised through an abdominal opening; occasionally, a small tumor situated near the lower part of the corpus uteri may be removed by vaginal section.

The mortality associated with myomectomy has been greatly reduced in recent years. The author has performed 85 consecutive operations with one death. In about 72 per cent. of these the abdominal route was employed; very rarely was the uterine cavity opened.

Technic.—1. By the vaginal route.

2. By the abdominal route.

1. By the Vaginal Route.—(a) *Small Subperitoneal or Interstitial Growths.*—Occasionally myomectomy may be satisfactorily carried out in such cases. The cervix is pulled down, and after curetage is carried out a circular incision is made through the mucosa covering the upper anterior part of the vaginal portion, extending half an inch on each side into the lateral fornix. The cervical musculature is bared, and the mucosal flap with the bladder is dissected upward until the anterior reflection of the peritoneum is found. The latter cavity is opened and the uterine body brought through the incision as much as is necessary to expose the tumor. If the growth is on the posterior wall, the fundus may even be pulled down into the vagina.

The uterine wall is then incised over the prominence of the tumor until the latter is exposed; it is then grasped with forceps and dissected out of its bed. The cavity thus produced in the uterine wall is then closed with continuous catgut sutures and the edges of the peritoneum on the surface inverted. After myomectomy is completed the uterus is replaced, the peritoneum closed, and the mucosal flaps sutured in their normal position.

(b) *Submucous Pedunculated Fibroids.*—(1) When the polyp does not project through the os externum, or only slightly so, dilation of the cervical canal should be carried out in the first place, but if, in this manner, sufficient room cannot be obtained for the securing of the pedicle, the following procedure should be adopted, viz., the cervix should be steadied with a volsella and the junction of the anterior vaginal wall and cervix divided transversely, the bladder being stripped upward as far as the os internum. If necessary, a circular incision may be made around the cervix so that the entire fornix may be elevated. The anterior lip of the cervix is then divided sagittally in its

whole length, bleeding points being caught with forceps. In this way sufficient working room is obtained.

Various methods of treating the pedicle are adopted. If small, the tumor may be held with forceps and twisted off. Or if large, twisting may be combined with snipping of the pedicle with scissors. The pedicle should not be divided too close to the uterine wall.

Some operators prefer to transfix the pedicle and secure it by means of a strong ligature, the tumor being cut away above it.

Others prefer to cut slowly through the pedicle with the *serre nœud* or the *écraseur*. Sometimes the nail-curet is used to divide it.

(2) When the tumor lies in the vaginal canal, the procedure varies in different cases. If the tumor be small, it may be pulled down easily along with the cervix, and the pedicle may be divided, as described above, inside the cervix. If the tumor be large, it may be necessary to reduce it in size before the pedicle can be reached.

This is best done by cutting circularly through the capsule, shelling the tumor out as far as possible, and then cutting away portion after portion of the tumor, bleeding being checked by means of forceps. When the pedicle is reached it may be ligated, and divided with the *écraseur* or with scissors. To pull down the tumor, large strong forceps are required.

Sometimes, to gain access to the vagina, it may be necessary temporarily to divide the perineum on each side.

If the cervix was opened by incisions, its walls should be again closed, as well as the incision into the anterior vaginal fornix by suturing.

After the removal of every tumor the uterine cavity should be thoroughly cleansed, and it as well as the vagina should be packed with antiseptic gauze. This may be removed on the third day, and antiseptic vaginal douches given daily for a week or ten days.

(c) *Submucous Nonpedunculated Fibroids*.—These growths are more difficult to remove than those which are pedunculated. In the case of very large tumors the abdominal route is necessary.

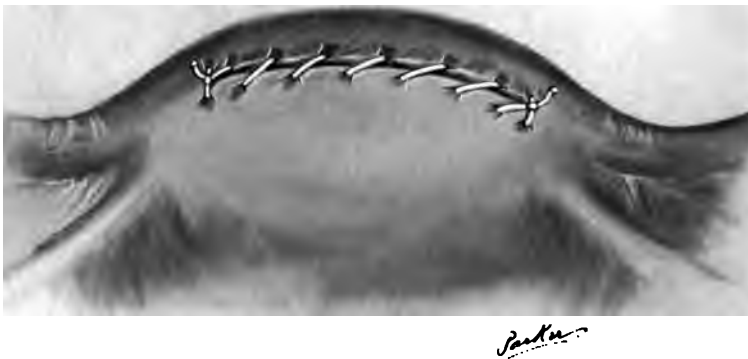
Small Tumors.—Where the tumor is small or of moderate size, its removal may be undertaken by way of the vagina. If the vagina be small, dilation by means of rubber bags and gauze packing may be employed for several days before the operation. The hand of an assistant should press the uterus downward through the abdominal wall during the operation. The cervix should be dilated, or, in order to gain still more room, it may be incised.

If bleeding be feared, the uterine arteries of both sides may be ligated by means of a strong, full-curved needle. If the tumor be only an inch or two in diameter, it may be enucleated *in toto*. The most prominent portion is held with a volsella. An incision as long as possible is made through the capsule along the line of junction of the prominent part of the tumor with the uterine wall. The tumor is then shelled out of the capsule with the fingers and a spatula, the mass being gradually drawn down with forceps.

It may sometimes be necessary to cut some of the adhesions with scissors. The tumor may be gradually twisted as it is withdrawn. If it is rather large to pull down *en masse*, it may be divided.

The bed of the tumor has now to be attended to. All loose shreds of tissue are removed, a hot uterine douche is given, and the raw cavity plugged with antiseptic gauze, which is prolonged into the vagina.

PLATE VI.



The upper illustration represents the uterine wall after removal of a fibroid (myomectomy). The lower illustration shows the appearance after the raw area has been closed by continuous catgut suture.

If the cervix has been divided, it is now closed, and the patient put to bed. Ergot is administered daily. On the fourth day the plug is removed, and antiseptic douches are given daily. If there should be any fresh bleeding, plugging can again be carried out.

Note.—The dangers of this operation are perforation of the uterus, inversion of the uterus, hemorrhage, incomplete removal of the tumor, septicemia.

Larger Tumors.—Removal of the mass bit by bit (*morcellement*) is advisable.

The cervix is first dilated somewhat.

The junction of the vaginal mucosa to the cervix should be circularly incised, and carefully stripped up as far as possible. The cervix is then incised on each side, so as to form an anterior and a posterior flap. Or it may be divided, so as to form two lateral flaps. The incision should reach up to the tumor. These flaps should be held in strong forceps, separated and pulled downward.

The prominent part of the tumor is then grasped with strong toothed forceps. With retractors the cervix and vagina are opened as much as pos-

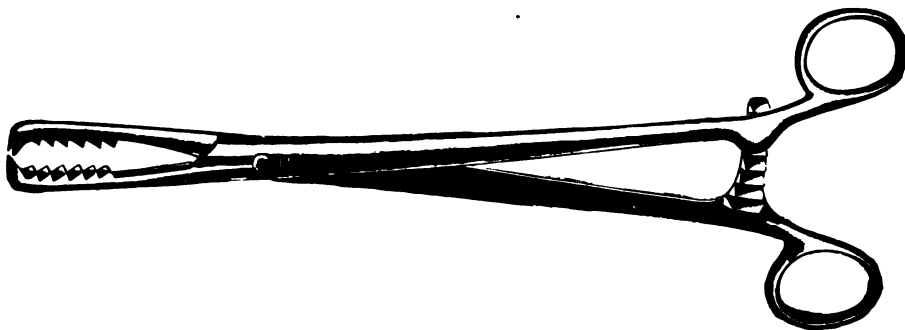


Fig. 312.—Prior morcellation forceps.

sible. An incision is then made in the tumor at right angles to its longest axis. One edge is grasped by forceps, and the piece of tumor cut away with scissors or knife below them. Before the portion is removed a grasp is taken above it with another pair of forceps in order that the tissue may not retract and bleed.

Usually the operation is not attended with much hemorrhage. What there is comes chiefly from the divided cervix. Forceps should be used to check this. Sometimes preliminary ligation of the uterine arteries may be employed in order to diminish bleeding.

The removal of the tumor piece by piece is continued until it is entirely taken away.

Sometimes when the lower part of the mass is removed the upper part may come away by twisting it.

In some cases more than one tumor may be removed by this method.

(If a small opening should accidentally be made through the uterine wall into the peritoneum, no particular measures need be adopted. If a large one occur, or if very extensive destruction of the uterus be caused by the morcellment, total extirpation (vaginal hysterectomy) should be performed at once.)

After the removal of the tumor, all bleeding points in the raw bed should be seized with long forceps. The cavity should be cleaned with an antiseptic douche, and between and around the forceps a gauze plug should be placed in the uterus and vagina.

After-treatment.—The patient is kept at rest, ergot being administered. In thirty-six or forty-eight hours the forceps and gauze are removed and the uterus afterward douched each day with an antiseptic solution.

Note.—This operation should be attempted only when there is a definite submucous tumor, not more than four inches in diameter. The risks of cutting into the peritoneum, of hemorrhage, sepsis, and shock from prolongation of the operation are always great.

(d) *Fibroids of the Cervix.*—(1) *Pedunculated.*—These are removed in a manner similar to that employed in the case of pedunculated fibroids of the body.

(2) *Interstitial.*—These are they which cause a large swelling in the cervix and tend to grow toward neighboring parts, *e. g.*, into the broad ligament.

The capsule of the tumor should be incised and enucleated or morcellation should be carried out. After removal, the resulting cavity may be closed by continuous catgut suture or packed with gauze. Care should be taken to avoid injuring the bladder or ureter.

2. By the Abdominal Route.—Preliminary to the following procedures curetage of the uterus and application of a strong antiseptic are advisable.

(a) *Subperitoneal Pedunculated Fibroids.*—After the abdomen is opened by the ordinary mesial incision the tumor is exposed and held with a volsella. If the pedicle be narrow, a circular incision is made through the peritoneal covering, which is stripped down as a cuff toward the uterus.

The exposed pedicle base is then secured with one or two catgut ligatures close to the uterus, and the tumor cut away external to the catgut. The peritoneal cuff is then turned over the stump and closed with fine catgut.

When the pedicle is broad, it is advisable to cut through it by a circular incision, the knife being held obliquely so that when the tumor is removed, the portion of the pedicle attached to the uterus is crater-like. This raw excavation is then closed by a continuous running catgut suture, the peritoneal edges being inverted.

(b) *Subperitoneal Sessile and Interstitial Fibroids.*—An incision is made through the capsule until the fibroid is exposed. The latter is then grasped by a volsella and the opening in the capsule enlarged sufficiently to allow of the removal of the tumor. The latter is shelled out of its bed by means of the fingers, aided by a blunt dissector; or it may also be necessary to cut tissue with scissors. The uterine cavity should not be opened into if possible. During the procedure bleeding points should be secured with forceps. After the tumor is removed, bleeding vessels may be secured with catgut ligatures applied with a needle, and the raw bed of the fibroid should be closed from below upward by a continuous catgut suture, the peritoneal edges being inverted. It is rare that satisfactory closure and complete control of hemorrhage cannot be obtained in this way. Ligation of the uterine arteries has been recommended by Kelly in cases where oozing cannot be checked. Schroeder's procedure of applying a rubber ligature around the cervix in order to control bleeding during the myomectomy is not at all necessary.

This operation may be employed in the removal of several fibroids from the same uterus. In one case the author removed thirteen, varying in size from three inches to half an inch in diameter.

Multiple myomectomy is not, however, advisable if a long period under anesthesia is required, especially if the patient be anemic. Large fibroids should not be removed in this way, even if single, because a considerable opening is apt to be made into the uterine cavity, and because the uterus which is left is not likely to be a satisfactory organ if pregnancy should occur at a later period; moreover, a considerable quantity of blood is apt to be lost in the procedure. In such cases supravaginal amputation or total hysterectomy should be carried out. Though many cases have been reported in which openings into the uterine cavity have been satisfactorily closed, several operators have lost patients by infection introduced into the peritoneal cavity in this way. Certainly myomectomy should never be performed if there be any doubt as to the sterility of the uterine cavity.

(c) *Intraligamentous Fibroids*.—These are tumors which develop from the lower part of the uterine body or upper part of the cervix and extend into the extrauterine subperitoneal tissues. They may grow forward, laterally, or backward, and may displace the bladder, ureter, rectum, or other structures.

Small pedunculated growths may usually be removed with ease after a careful dissection from surrounding structures, the pedicle being tied close to the uterus.

After removal of the tumor bleeding vessels should be ligated and the raw tumor-bed should be covered by the peritoneum which was raised above the tumor. A. Martin has recommended making an opening into the vagina from the cavity remaining after removal of the tumor, and packing the latter with gauze the lower end of which is carried into the vagina. The incision that was made in the peritoneum that covered the tumor is then sutured, and the abdomen then closed.

Large intraligamentous fibroids should not be removed by myomectomy unless they have a small pedicle; also when these tumors are sessile, fixed, or have complicated relationships with surrounding structures, removal may be very difficult, bleeding may be excessive, and important structures may be injured. In such cases it is best to remove the uterus along with the tumor.

C. Methods which Remove the Tumor with Part or the Whole of the Uterus.

1. Removal of the tumor with the body of the uterus—supravaginal amputation.

2. Removal of the tumor with the entire uterus—abdominal hysterectomy; vaginal hysterectomy.

Until within the last few years the most frequent major operation performed in the case of fibroid tumors was supravaginal amputation with fixation of the stump in the abdominal parietal incision.

This operation has been almost entirely abandoned, owing to the troubles associated with the treatment of the stump, *e. g.*, sloughing, ulceration, protracted healing, risk of infection, traction on the pelvic structures after herniation. Intraperitoneal treatment of the stump has become a very favorite practice in recent years. In the earlier days of this method necrosis and sup-

puration of the stump were frequently reported, to such an extent that some operators abandoned the procedure entirely. Now, owing to improved technic, the operation of supravaginal amputation with intraperitoneal or rather subperitoneal placing of the stump is a valuable and comparatively safe operation, and is preferred by many operators to the complete abdominal hysterectomy.

The former operation may usually be performed in a somewhat shorter length of time than the latter; there is less hemorrhage; the anatomic relationships of the pelvic floor are better preserved, and there is less risk of wounding the ureters. (It is also urged by some that ovarian atrophy follows removal of the entire uterus within two or three years, and that the preservation of the cervix prevents this.)

Richelot and others have recently tried to discredit this operation, because of the occasional occurrence of malignant disease in the stump afterward. Very few instances of this nature have as yet been reported, but their rarity should not cause operators to neglect the careful examination of the cervix previous to operation. Whenever the latter is found to be pathologically altered, it would probably be a wise precaution to remove the entire uterus.

A more serious objection to the performance of supravaginal amputation is the occasional association of fibromyoma and malignant disease. In a considerable percentage of cases this is never suspected or discovered until the specimen is examined after removal. If, therefore, an operator does not practise total extirpation in every case, he should curet the uterus thoroughly and examine the scrapings microscopically before carrying out the major operation. Such a procedure would undoubtedly increase the percentage of exact diagnoses, but there would still remain a small percentage of uncertain cases, viz., those in which the malignant disease could not be reached by the curet. It must, therefore, be concluded, from the standpoint of malignancy in association with fibroids, that total extirpation of the whole uterus is the most scientific procedure.

As regards the mortality associated with these operations, the author's records at the end of 1904 were as follows:

Vaginal hysterectomy.....	36	with 1 death.
Abdominal panhysterectomy.....	46	" 1 "
Abdominal supravaginal amputation.....	48	" 4 deaths.
	130	with 6 deaths.

One death after abdominal supravaginal amputation was due to nonseptic pneumonia; two resulted from sepsis; another occurred immediately after operation, due to shock and loss of blood. One patient died after abdominal panhysterectomy from nonseptic pneumonia. One fatality followed vaginal extirpation of a suppurating myomatous uterus, the patient being septic at the time of operation.

As regards the choice between the vaginal or abdominal route where removal of the tumor and the whole uterus is to be carried out, it is to be said that the former has a very limited field; for while in general vaginal extirpation under favorable conditions is less disturbing to a patient than the abdominal operation, there are many cases in which the former operation is longer than the latter, and accompanied with more hemorrhage. Vaginal hysterectomy

PLATE VII.



Abdominal extirpation of the myomatous uterus. The upper illustration shows the round ligaments and the left ovarian vessels tied. A ligature is being passed through the right infundibulopelvic ligament on the right side, for the purpose of securing the right ovarian vessels. The lower illustration shows the broad ligament divided and the bladder pushed downward in order that the uterine vessels may be ligated.

should not be attempted if the tumor be larger than a four months' pregnant uterus, or if it be adherent or intraligamentous, also if there be marked disease of the appendages, especially if the vagina be narrow. The risk of injuring the bowel, bladder, or ureter, of leaving extensive raw surfaces, or of causing much hemorrhage is far greater in the vaginal operation when such complications exist than in the abdominal operation.

1. **Supravaginal Amputation.**—Removal of the tumor with the body of the uterus.

In all cases previous to the abdominal operation the uterine cavity or as much of it as can be reached should be cureted and afterward swabbed with a strong antiseptic, *e. g.*, iodized phenol or strong formalin. A strip of antiseptic gauze is then placed in the vagina. The abdominal procedure is then carried out, the patient being placed in the Trendelenburg position. It varies slightly according to whether one or both ovaries are to be left or removed. It is not necessary to remove them unless they are diseased, though many operators make it a habit to take them away if the patient is at or probably near the climacteric. The metabolic value of the ovaries to the system is too often forgotten by reckless gynecologists.

(a) *When the Ovaries are Healthy.*—The upper part of each broad ligament below the tube is tied with strong catgut, the utero-ovarian ligament being also secured by the ligature, which is placed close to the ovary. Each tube is then removed, the raw edge of the broad ligament being secured by a fine catgut suture.

The broad ligament is then divided between the uterus and the ligature. Bleeding vessels on the side of the uterus are secured with forceps.

Each round ligament is then ligated close to the uterus, and divided on the uterine side of the catgut. If the uterine end bleeds, it is compressed with forceps.

A transverse incision is then made through the peritoneum covering the anterior wall of the uterus, about half an inch above the bladder, joining the cut ends of the round ligaments.

The peritoneum below the incision is then pushed downward along with the bladder, the round ligaments, and the anterior layer of each broad ligament near the uterus. In this way the uterine vessels are exposed. They are then ligated with catgut close to the uterus.

The undivided portion of the broad ligament is then cut from the uterus down to the level of the uterine vessels, and the latter are divided between the ligature and the uterus. The uterus and tumor are then held up and the level of amputation chosen, a pair of forceps being attached to the cervix on each side. Careful examination is made to show that the bladder is well below this level, and circular amputation is then carried out with a knife, the point of which is directed downward and inward toward the cervical canal. When the amputation is completed, the cervical stump presents a crater-like depression. The cervical canal is then cauterized and swabbed out with a strong antiseptic, and the stump is closed with a continuous catgut suture.

Each round ligament is then stitched to the top of the stump, and the latter is covered by the peritoneum attached to the bladder, which is stitched to the peritoneum on the posterior surface of the cervix by a continuous catgut suture. The raw edge of the broad ligament internal to each ovary is then closed.

The result of this procedure is to leave a pelvic floor entirely covered with peritoneum, no raw surface being anywhere exposed. Each ovary lies a short distance external to the stump. The abdomen is then closed.

I have never drained the abdominal cavity after supravaginal amputation. If, in the course of this operation, the peritoneum has been contaminated, *e. g.*, by a pus-tube or ovarian abscess, I have changed my procedure and carried out complete removal of the uterus, draining the pelvis by the vaginal opening.

(b) *When the Ovaries are Diseased.*—In this condition the procedure differs somewhat in the early stages, owing to the necessity for removing the ovaries as well as the tubes.

In the beginning the infundibulopelvic ligament containing the ovarian vessels is ligated with catgut. The broad ligament is then divided horizontally as far as the uterus, below the level of the ovary and utero-ovarian ligament. Bleeding points are secured with forceps. The round ligaments are then tied, and the various stages carried out as already indicated in the preceding operation.

Variations.—The operation just described is that which I have employed in the great majority of my supravaginal amputation cases. Variations in the procedure are necessary in some instances, owing to the relationships of the tumors. Thus, when there is a large intraligamentous growth on one side, it is sometimes advisable to follow the plan advocated by Pryor and Kelly, of ligating the ovarian and uterine vessels on the free side, dividing the round and broad ligaments of that side, dissecting the bladder from the cervix, cutting across the latter, ligating the vessels of the opposite side, enucleating the tumor, and, finally, ligating the remaining ovarian vessels.

In some cases, however, it is best to follow another plan of Kelly's, *viz.*, to bisect the tumor and to enucleate it by rolling each half upward, separating it from its capsule, afterward amputating the cervix.

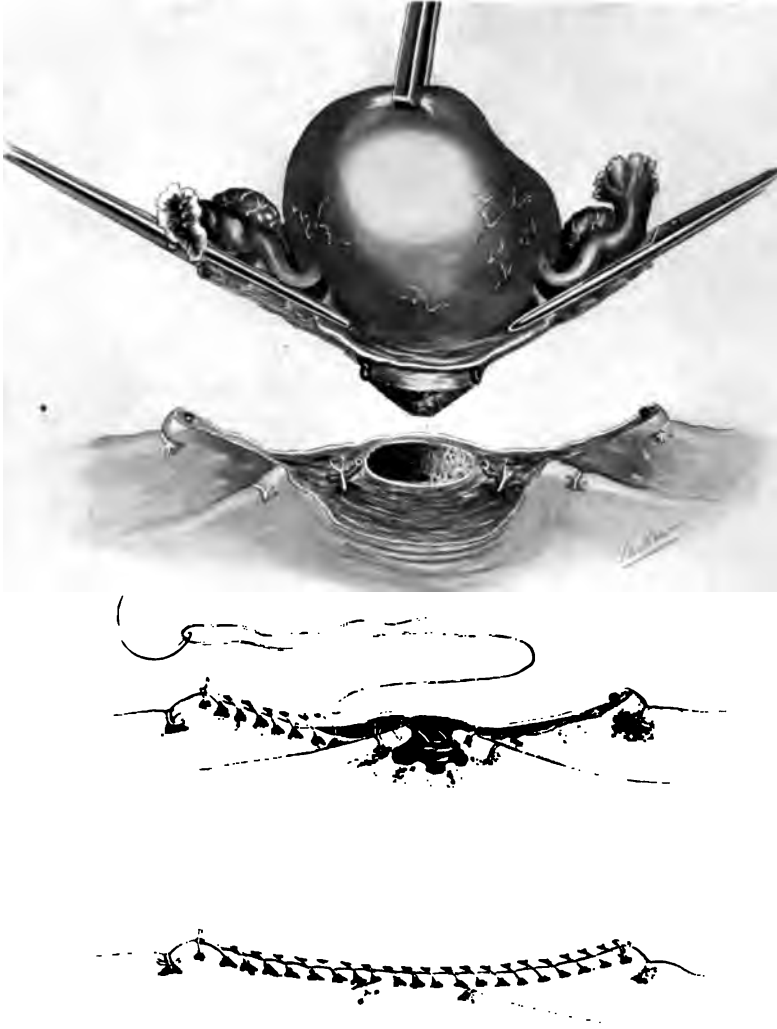
In cases in which a fibroid develops mainly within the pelvis, whether intraligamentous or not, it may disturb the relationships so that the ovarian or uterine vessels or both cannot be found and tied. In such a case most operators proceed with enucleation, tying and clamping vessels as they appear. This process is slow and may be accompanied with much loss of blood. Kelly recommends dealing with such cases by sagittal bisection of the uterus and tumors, enucleation being thereby rendered easy and the large vessels made accessible.

He advises such a plan also when the adnexa are diseased and inaccessible behind and below the fibroid mass. After the enucleation the uterus may be amputated or removed entirely. Sometimes when a large irregular mass is caused by a number of fibroids projecting in various directions, removal is simplified if several tumors first be enucleated, as was recommended by Pean. This is especially advisable in the case of growths which extend forward under the bladder or elsewhere extraperitoneally.

2. Removal of the Tumor with the Entire Uterus by the Abdominal Route.—(a) **Abdominal Hysterectomy.**—The following procedure has given the author the greatest satisfaction:

The first stages are identical with those above described in connection with the operation of supravaginal amputation (which see) as far as ligation of the uterine vessels and separation of the broad ligaments from the uterus as low

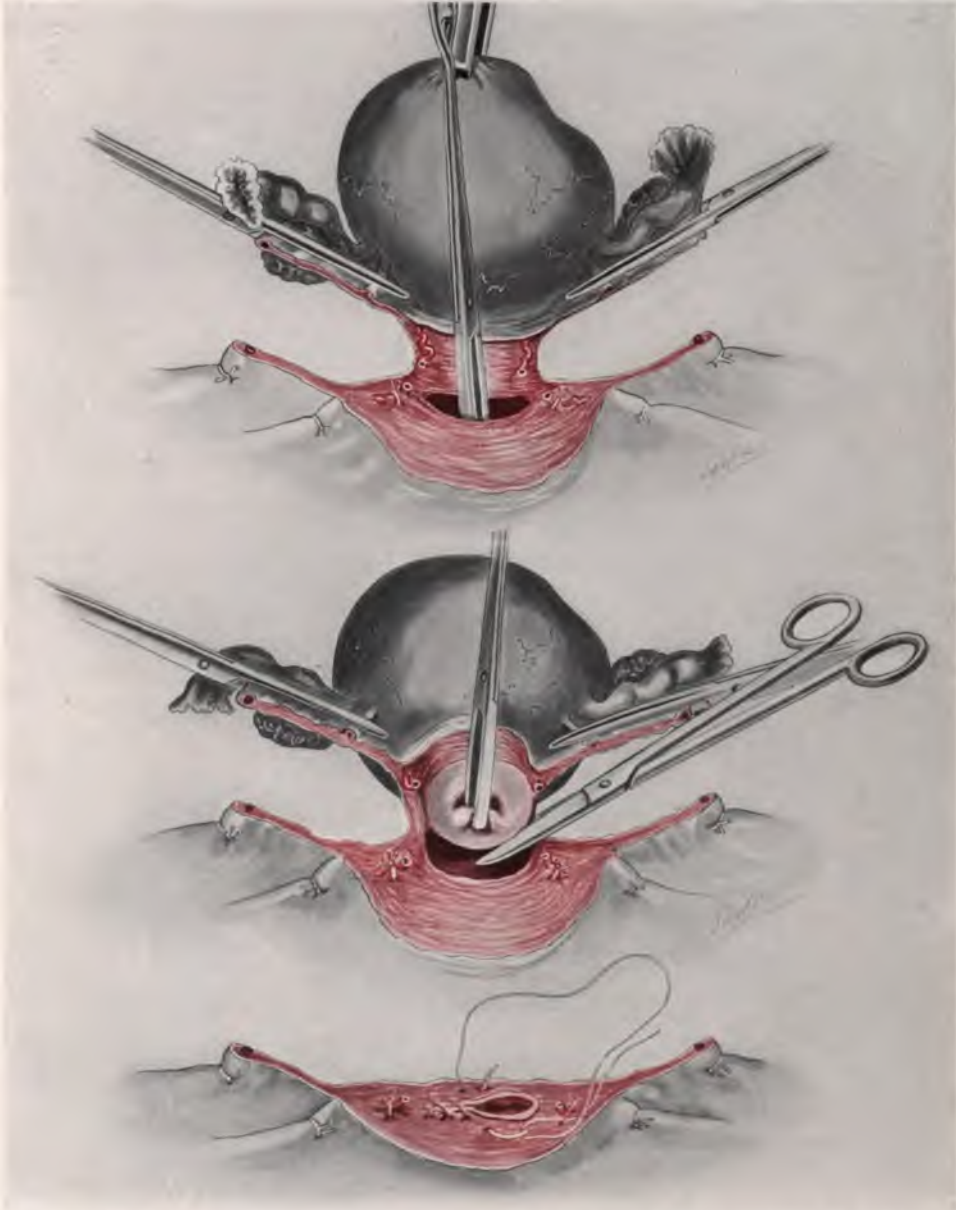
PLATE VIII.



Abdominal extirpation of the myomatous uterus by supravaginal amputation. The upper illustration shows the ligation of the ovarian and uterine vessels and round ligaments, and the crater-like depression in the cervix after amputation. The middle illustration shows the raw crater in the cervix closed, the suturing to it of the round ligaments and the approximation of the peritoneal flaps. The lower illustration shows the appearance when the latter stage is finished.

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PLATE IX.



Abdominal panhysterectomy for myoma uteri. The upper illustration shows the ovarian and uterine vessels secured, the bladder pushed down, and the anterior vaginal vault opened close to the cervix. The middle illustration shows the complete separation of the cervix from the vaginal vault. The lower illustration shows the closure of the vaginal opening.



as the upper part of the cervix. The bladder should next be carefully separated from the rest of the cervix, and pushed downward until the upper end of the vaginal wall is exposed. The uterus is then drawn upward and backward and the vagina is opened by a transverse incision made through the anterior fornix. This level is easily determined by palpation of the cervix with the fingers. The gauze tampon previously introduced into the vagina may also be felt.

The incision is then continued around the fornix, the knife or scissors being held close to the cervix. In this way the uterus is completely freed from its vaginal connections.

Bleeding points are temporarily secured with forceps, and, later, with catgut. The edge of the peritoneum posterior to the bladder is next stitched to the cut end of the anterior vaginal wall. The ends of the round ligaments are drawn downward and stitched to the vaginal wall on each side. The raw margins of the broad ligaments are closed with continuous catgut. The opening into the vagina is finally closed with catgut, the peritoneal flap posterior to the bladder being stitched to the peritoneum covering the upper part of the posterior vaginal wall. The abdomen is then closed. The vaginal gauze is removed after three days, antiseptic douches being afterward given daily.

Variations.—In about 92 per cent. of his abdominal hysterectomies the author has followed this procedure exactly.

In cases in which multiple tumors form an irregular mass or disturb normal relationships considerably, preliminary enucleation of one or more masses is advisable, and in carrying out this procedure it may be necessary to split the tumors. In the rare complication of extensive adhesions of intestines to the upper part of a growth extending high in the abdomen in which separation of tumor is impossible, Kelly has successfully carried out the following plan, viz., detachment of the bladder from the uterus, elevation of the latter, ligation of the uterine vessels, bisection of the uterus and fibroids, enucleation, and removal.

The part of the capsule adherent to the intestines is not removed and the abdomen is drained.

The employment of the combined abdominal and vaginal routes I have rarely found necessary in hysterectomy for fibroids. In the case of a large intra-abdominal mass associated with a fibroid polyp projecting into the vagina I have been accustomed to remove the latter per vaginam, carrying out abdominal hysterectomy afterward; on the same occasion, if the patient be in good condition and the uterine cavity and vagina be aseptic; in two sittings, if these conditions are wanting. Also, in the very rare combination of a large abdominal fibroid growth of the body and carcinoma of the cervix I have ligated the ovarian and uterine arteries and removed the fibroid mass by the abdominal route, at the same time freeing the uterus and upper part of the vagina from surrounding structures. Then, placing the patient in the lithotomy position, I have removed the rest of the uterus and upper part of the vagina. In one case, after commencing vaginal extirpation by morcellation, I was forced to desist because of difficulty in drawing down the uterus owing to adhesions, completing the removal by the abdominal route. Rarely after this operation have I drained the pelvis through the unclosed vaginal opening, viz., in cases in

which the fibroids have been associated with a tubal or ovarian collection of pus which has ruptured during removal, when I have been uncertain as to its sterility. I have never employed abdominal drainage save in one case, where, in removing a subperitoneal suppurating fibroid, I was forced to leave a thin portion of the wall on account of intimate union with a coil of adherent intestines.

(b) **Removal of the Tumor with the Entire Uterus by the Vaginal Route—Vaginal Hysterectomy.**—This operation should always be preceded by thorough curetage and application of a strong antiseptic, *e. g.*, formalin, to the interior of the uterus.

A circular incision is made through the mucosa covering the vaginal portion of the cervix, and this is extended into each lateral fornix.

The mucosal flap is stripped upward along with the bladder. The peritoneal cavity should be opened in front and behind if possible and the uterine vessels ligated on each side. The base of each broad ligament is then divided close to the uterus. Bleeding points in the edges of the vagina may be secured with catgut. The cervix is pulled down as far as possible and divided anteroposteriorly. If it be much enlarged, portions of it may be removed at this time. The uterine body and fibroids must next be reduced in size, and this is carried out by morcellation or reduction bit by bit (see p. 541). An endeavor must be made to cut away the fibroid growths as much as possible from within the uterine covering, but frequently the latter must be removed as well as the portions of tumor. Before cutting away a portion a volsella must be inserted into the tissue beyond the line of incision, so that no retraction may take place. In excising the wall of the uterine body the lateral areas near the broad ligaments should not be encroached upon because of the risk of increasing hemorrhage. Small growths may be shelled out of their beds without being cut. During this procedure the uterus is pulled down with volsellæ and the vagina is well opened by retractors. The downward traction tends to diminish loss of blood, which usually is not marked unless there has been failure to ligate the uterine vessels.

When the tumors are removed sufficiently to allow the remainder of the uterus to be turned down into the vagina, the rest of the broad ligament on each side is ligated and the uterus is cut away. If the appendages are diseased, they should be removed, the infundibulopelvic ligaments with the ovarian vessels being first secured.

The stumps of the broad ligaments are then turned downward and fastened into the vault of the vagina, one on each side, and the edges of the opening into the peritoneal cavity closed. In this way the raw tissue of the broad ligaments is made to lie extraperitoneally and the adhesions which form between them and the lateral fornices help to support the vaginal wall afterward. A chin-sol gauze tampon is then placed in the vagina. It is removed on the third day, antiseptic douches being continued daily afterward.

I have never drained the pelvis after this operation save where I have ruptured an abscess of the tube or ovary, or where the fibroid has been infected. Then I have left the vaginal vault open between the ligaments and have introduced chin-sol gauze for three days, vaginal antiseptic douches being afterward employed.

CYSTIC TUMORS OF THE UTERUS.

The following varieties of cystic tumors are met with:

Cystic Fibromyoma or Fibrocystic Tumors.—These are fibromyomata, in which collections of fluids have formed. In some cases myxomatous or colloid degeneration of the connective tissue between the muscular bundles is the starting-point of the condition, or an edematous infiltration; there are no distinct walls in the cysts formed, as they are formed simply as lacunæ in the tissue of the tumor itself.

The majority of these cysts are found in subperitoneal fibroids. Of 70 cases collected by Heer, 63 were subperitoneal, 5 intramural, and 2 sub-mucous. The cysts are generally multiple, one usually predominating markedly over the others. In some cases growth may be rapid. Sometimes very large swellings are formed. The author has reported one which weighed 87 pounds; Severance one of 195 pounds.

Pedunculated cystic growths are especially apt to become twisted and, consequently, to be congested, edematous, adherent. Infection and suppuration, gangrene, and thrombosis have been frequently noted. The contents vary from a thin, clear, serous, to a thick, opaque fluid, which may be variously colored.

Rarely cysts may be formed as the result of dilations of lymphatics, the so-called *fibromyoma lymphangiectodes*. The cysts are usually lined with endothelium, though this may not be easily distinguished in large ones. The fluid coagulates spontaneously on exposure to air. Sometimes there may be, as well, a condition of dilation of blood-capillaries—*fibromyoma telangiectodes*.

Sarcomatous degeneration may sometimes produce a cystic condition. Hemorrhages may take place into cysts in all the above-mentioned varieties, causing them to increase in size. Rupture into the uterine cavity may sometimes take place.

If the cervix be obliterated, as is sometimes the case in women after the menopause, the cavity of the uterus may be gradually distended, forming a large blood collection.

Cystic Adenomyoma.—These are fibromyomata in which cysts are found lined with cylindric epithelium. Diesterwey was one of the first to notice these, and they have been fully described by Ricker, Nagel, Breus, von Babes, von Recklinghausen, Meyer, and others. Klein has traced a Wolffian duct in the uterine wall, giving off various branches. They occur chiefly at the junction of the tube and uterus. (Similar growths are found in connection with the tube alone.) They develop in the muscular part of the wall, and may extend outward to the peritoneum or into the broad ligament; they may thus infiltrate surrounding tissues diffusely, differing from pure fibromyomata. They tend to form adhesions. Von Recklinghausen classifies the tumors as follows:

1. Hard masses in which the adenomatous development is scanty.
2. Those in which many small cysts are discoverable by the microscope.
3. Soft masses in which cysts of various sizes exist, which can be seen by the naked eye.
4. Very soft telangiectasic growths in which adenomatous tissue is present, but few or no cysts.

He believes that these growths are developed from remains of the Wolffian bodies which have remained in the uterine wall.

He also describes a rare form of cystic adenomyoma, which is distinguished by its intimate connection with the uterine mucosa. Its adenomatous structure resembles that of the mucous membrane, and a number of depressions pass from the latter into the tumor.

Many believe that in some cases the cysts are derived from Müllerian remains or from inclusions of deep-lying ends of the mucosal glands.

These tumors are less apt to form peritoneal adhesions than the other variety. They are apt, however, to become carcinomatous.



Fig. 311.—Large blood cyst of the uterus developing in a woman three years after the menopause.

Freund has arranged the symptoms of cysto-adenomyomata as follows: There is often a history of poor health in childhood. Menstruation appears late. Menorrhagia and dysmenorrhea are very constant. Sterility is common. The general health gradually fails. The external genitals and vagina are usually undersized.

Blood Cyst of the Uterine Wall.—In 1895 I described an interesting case in which a large, unilocular blood cyst developed from the wall of the

uterus three years after the menopause. The patient in whom it occurred first noticed the swelling about a month after she had strained herself severely, pelvic pains being set up. In five months' time great distention of the belly was caused.

The cyst-wall was deeply congested, contrasting with the pale uterus. It had elongated the fundus into a kind of pedicle.

The cyst-wall varied in structure. The fibrous tissue predominated over the muscular, and in many places was dense and sclerosed; in many places the muscle was atrophied. Throughout the wall many dilated capillaries were found. The cavity contained blood, granular débris, flakes of fibrin, and a few cholesterin crystals. In the elongated fundus, which was largely composed of connective tissue and atrophying muscular bundles, a collection of cavities containing blood was found, about the size of a walnut; it resembled an angioma, and seemed to consist of dilated capillaries. No sign of a myoma was seen anywhere in the wall.

I believe that this tumor arose from an angiomatous condition of the fundus, the sudden strain which the woman made leading to a rupture of the wall of one of the blood-spaces, and to a gradual accumulation of blood, slowly poured out, forming a large blood cyst.

Diagnosis of these Various Conditions.—The symptoms are much the same as in the case of fibroids, except that usually they develop more quickly. As most are subperitoneal, there may often be no menstrual disturbances. On physical examination the conditions found in fibroids are present, except that in addition cystic characters are made out. But, as I have already said, a soft myoma may simulate a cyst in character. The cystic fibroid is most readily mistaken for ovarian cystoma. It may also be regarded as a fibroid with pregnancy.

Treatment.—In these cases the procedure varies according to the extent of the cystic formation. If there be one pedunculated cyst, it is removed just as is a subperitoneal fibroid. If the cystic disease is extensive, amputation of the uterus or panhysterectomy should be performed. To make the mass as small as possible the cyst may be tapped before removal is carried out.

FIBROIDS AND PREGNANCY.

Uterine fibroids are frequently associated with sterility. Charpentier's statistics show that in 1554 cases there was sterility in 476. Hofmeier states that the percentage is not greater than in women with a normal uterus. The exact relationship between this disease and conception is unknown, since pregnancy or sterility may be found with all varieties of fibroids.

In some instances pregnancy and labor may run a normal course. This is especially the case when the fibroids are small or few, when they are subperitoneal and placed high on the uterine body, and when they do not grow rapidly. But in many cases complications more or less serious are produced.

Pressure symptoms may be present in the early months when the tumor or tumors lie within the true pelvis, especially if they are intraligamentous. Sometimes at this period a pedunculated subperitoneal growth may lie deeply in the pelvis, and in such cases the mass may become impacted. Occasionally prolapse or retroversion of the uterus may be caused in the early months. In advanced gestation pressure symptoms may be caused by multiple or large

tumors. Intra-uterine hemorrhages may be caused, especially when sub-mucous tumors are present. Placenta prævia is found in a larger percentage of cases than where the uterus is normal. Rarely, spontaneous thinning and rupture of the uterus may take place. Fibroids are frequently a cause of premature emptying of the uterus, though Hofmeier believes that this is not so common as is generally believed. He states that in 796 cases this complication took place in only 6.9 per cent. Nauss, however, describes it as occurring 47 times in 241 cases.

In a number of instances in advanced pregnancy death of the fetus has not been followed by its immediate expulsion, even though the liquor amnii has escaped; decomposition of the uterine contents is likely to follow retention. Pujol finds that in 100 cases, 53.82 per cent. presented by the head, 27.18 per cent. by the breech, and 19 per cent. were transverse. Malpresentations and malpositions are frequent. Labor-pains may be weak, irregular, and ineffectual. Of great importance are the effects produced by large fibroids (which may also be present when they are not complicated by pregnancy)—viz., degeneration of the cardiac muscle and of the renal and hepatic epithelium. The heart may also be dilated more than in normal pregnancy.

The **symptoms** vary considerably. In some cases the tumors cause no disturbance. When pressure is present, there may be pains in the abdomen or pelvis, varicose veins, edema, weakness or pain in one or both lower extremities, edema or varicose veins in the vulva, and hemorrhoids. There may be various disturbances of the bowel and bladder. There may be diminution of the quantity of urine and of its solids; albuminuria and casts may be present. There may be symptoms resulting from cardiac weakness. Frequently the patient's discomfort is aggravated on exertion. The rhythmic uterine contractions, which normally are painless, are sometimes excessive and painful. Blood may escape from the uterus at times even though abortion be not produced.

The effect of pregnancy on fibroids varies. They tend to grow, the rate varying greatly, those that are interstitial increasing most rapidly. The consistence may change considerably; sometimes a tumor may become much softer. Occasionally there may be a complete breaking down of the central portion. Tarnier and Budin state that fibroids may become alternately harder and softer, like the uterine wall in pregnancy; it is uncertain whether this is due to activity of the muscle-fibers in the tumor or to that of the surrounding uterine muscle, the tumor remaining inert. It is doubtful if this muscular activity is found in any but soft myomata, and in more than a very slight extent.

The **diagnosis** of fibroids and pregnancy is beset with difficulties. In some cases the fibroids may be regarded as parts of the fetus, or they may be missed when situated on the posterior part of the uterus. Frequently the pregnancy may be entirely overlooked, or diagnosed as a cystic swelling in connection with the tumors. Sometimes pregnancy with fibroids is regarded as multiple pregnancy. In the early months a single fibroid with pregnancy may resemble an enlarged metritic uterus. Very frequently a fibroid may simulate the uterine body in shape, the pregnancy being considered as ectopic; or sometimes the latter may be diagnosed as an ovarian cyst. Occasionally there may be a simulation of a bicornute uterus with pregnancy in one horn.

Sometimes a fibroid may be mistaken for a tubal or ovarian swelling. Examination must be carried out repeatedly and with great care, anesthesia often being necessary. In some cases an absolute diagnosis cannot be established.

Treatment.—When there are one or more small tumors, causing no symptoms, the case may be allowed to proceed to full time, frequent examinations being made to determine the relationships of the fibroids and their rate of growth. If in the early months a subperitoneal tumor lying in the pelvis is in no danger of becoming impacted, an effort should be made to raise it above the brim by placing the patient in the genupectoral position, the lower bowel and bladder having been emptied, and digital pressure being made through the vagina and rectum. If this is unsuccessful after two or three attempts have been made, either abortion must be induced or an abdominal section must be performed in order that the tumor may be removed. After the latter operation there is a considerable chance that the pregnancy may continue. When a large interstitial tumor is situated in the fundus of the uterus, it is possible that the pregnancy may continue without danger. Such growths may sometimes be safely removed by myomectomy without interruption of the pregnancy. This operation may, however, lead to abortion. Staveland, in 1894, published an account of 33 cases of myomectomy during pregnancy. The maternal mortality was 24.25 per cent.; in the cases operated upon between 1885 and 1889 it was 16.66 per cent.; in those operated upon between 1889 and 1894 it was 11.75 per cent. In 30.30 per cent. abortion occurred. Twenty of the cases went to full term. Duncan Emmet has reported 44 cases as occurring between 1890 and 1900, with a maternal mortality of 9 per cent. The operation of myomectomy must have a very limited sphere in pregnancy. It is unnecessary to remove very small tumors. Those which are large and interstitial should not be removed in this way because of the risk of rupturing the stitched area in case abortion should occur, or even if a full time-labor should take place. Practically it need be carried out only in the case of subperitoneal fibroids that are situated low enough to be a source of danger at full time, or which have such long pedicles that they are apt to fall into the pelvis.

If an interstitial fibroid be situated near the cervix, there is risk of impaction in the early months and of obstruction in the case of labor in the late months. Abortion should, therefore, be induced early if it can be carried out safely and without much difficulty. Otherwise it may be advisable to perform hysterectomy by the vaginal or abdominal route. Removal by myomectomy should not, as a rule, be attempted in such cases, at least until the uterus has been emptied.

Recently the author has had a case in which a four-months' gestation was associated with a fibroid of the anterior uterine wall, larger than the head of a new-born child. Severe hemorrhage had occurred. The uterus was elevated in the abdomen to such an extent that it could not be emptied per vaginam.

Abdominal section was performed, and the tumor was removed. Through the bed of the tumor the uterus was opened and the pregnancy removed. The uterine wall was then closed with catgut. The patient made a good recovery. Where there are several tumors, large in size, rapid in growth, or causing pressure symptoms, abdominal hysterectomy should be performed.

In a number of cases in advanced pregnancy a viable fetus may be removed from the uterus before the latter is excised. Sometimes the parents desire to prolong gestation as far as possible in order to insure viability. They should always be warned that delay may increase the risk to the mother if the tumors cause much pressure or if the heart and kidneys are not acting satisfactorily.

In opening the uterus for the removal of the fetus it may be necessary to make an irregular incision, and bleeding may be profuse, because the tumors prevent the uterine wall from retracting and contracting firmly.

Cervical fibroids are very rare. They may be usually removed per vaginam and pregnancy may not be interrupted. Even a submucous fibroid polyp projecting into the cervix may sometimes be removed without rupture of the amniotic membrane.

As regards the conduct of labor in cases of fibroids, a text-book of obstetrics should be consulted.

CHAPTER XVIII.

OTHER AFFECTIONS OF THE UTERUS.

CARCINOMA UTERI.

Primary Cancer.—*Introductory.*—Primary cancer may develop either in the cervix or in the body of the uterus. In about 98 per cent. of cases the disease begins in the cervix. As regards its frequency, Roger Williams estimates that, next to cancer of the mamma, it is the most common cancerous manifestation in women. He estimates that in England and Wales one in thirty of all women over thirty-five dies of a mammary carcinoma, and one in thirty-five of a uterine carcinoma. Welch, however, is inclined to place the uterus first among the organs affected with primary cancer.

The majority of cases of carcinoma uteri are met between the ages of forty and fifty. The following table of Gusserow, in which 3471 cases are analyzed, is interesting. The disease occurred at:

AGE.		AGE.	
17	in 1 case.	40-50	in 1196 cases.
19	" 1 "	50-60	" 856 "
20-30	" 114 cases.	60-70	" 340 "
30-40	" 770 "	Above 70	" 193 "

R. Williams' analysis of 500 cases is as follows:

AGE.		AGE.	
20-25	0.2 per cent.	50-55	13.0 per cent.
25-30	7.0 " "	55-60	9.0 " "
30-35	11.0 " "	60-65	5.0 " "
35-40	20.0 " "	65-70	1.0 " "
40-45	17.0 " "	Above 70	0.8 " "
45-50	16.0 " "		

Several cases of the disease have been reported earlier than seventeen, but it is probable that in most of them the malignant growth was sarcomatous.

Ganghofner's case was described as a papillomatous outgrowth and may have been nonmalignant. In 100 cases observed by R. Williams the disease was first noticed:

Before the menopause in	50
About the time of the menopause in	21
After the menopause in	29

Cancer develops later on the average in the corpus of the uterus than in the cervix, the majority of cases occurring between fifty and sixty years of age.

R. Williams gives the following table:

AGE.		AGE.	
20-30	8.3 per cent.	50-60	51.2 per cent.
30-40	3.6 " "	60-70	16.7 " "
40-50	19.0 " "	Over 70	1.2 " "

This author also states that cancer of the uterus is more frequent in dark-complexioned women than in blondes. It is, however, stated by Chisholm

and other American authors that it is less frequent among negroes than among white women. It is probably more common among civilized than among uncivilized nations, and more frequent in the temperate regions than in the tropics. Hereditary predisposition has been observed in many instances, but there is some difference of opinion as to the percentage of cases in which this is noted. In 142 cases investigated by R. Williams there was a family history of carcinoma in 19.7 per cent.

As regards the family history, this author finds that pulmonary tuberculosis has been more common where there is a tendency to cancer, and states that a large proportion of cancer patients are the surviving members of tuberculous families; also that insanity, apoplexy, and joint diseases are more frequent in cancer families. And again he has found a higher percentage of longevity among the parents of cancer patients than among others. Great fecundity has also been noted in uterine-cancer families. It has long been believed that there is a greater prevalence of this cancer among the poor and ill-nourished. Various writers, however, deny this, and hold with R. Williams that it is more frequent among the well-to-do and well-nourished classes. It is also generally believed that the disease is less common in vegetarian than in flesh-consuming communities. Alcoholism does not seem to favor its development, at least in the uterus. It occurs in married women in the great majority of cases. Of 344 cases tabulated by R. Williams, 96 per cent. had been married; and it was more frequent among those who had borne children, though its occurrence was not at all proportionate to the degree of multiparity. Women with cancer of the corpus uteri were found to have been less prolific than those with carcinoma cervicis. In the majority of cases of the disease the onset is not noted until several years after the cessation of child-bearing. It is widely believed that lacerations and erosions of the cervix are important in determining the occurrence of cancer, but it is probable that their influence has been exaggerated. Certainly the disease is not more apt to occur in women who have had difficult and instrumental labors than in those who have had normal deliveries. Neither does it occur to a greater extent among those who have had marked uterine or pelvic disease.

Secondary Cancer.—Only a few words are necessary in reference to invasion of the uterus with cancer by metastasis from other parts, and while there may be direct tissue invasion or lymphatic extension from bowel, bladder, vagina, ovary, etc., metastases from distant organs are rare. R. Williams states that they occur more frequently in the mammary cancer than in any other variety, and that these metastases are usually multiple and are mostly found under the peritoneum of the corpus uteri.

VARIETIES OF PRIMARY CANCER OF THE CERVIX.

Carcinoma may develop either from the squamous epithelium covering the vaginal portion of the cervix or from the columnar epithelium lining the canal and its glands. There is some difference of opinion as to the relative frequency of these.

Cullen states that in 141 cases 123 were of the squamous and 18 of the glandular variety. R. Williams, on the other hand, says that 90 per cent. are of the latter variety, and regards this as the typical form of uterine cancer.

There are also different views as to the most frequent site of origin. Hofmeier reports that in 422 cases 236 developed in the portio and 186 in other portions of the cervix. Saurenhaus examined 50 cases and found 19 arising in the portio and 31 above it. Baecker reports 683 cases, describing 379 as cervical and 282 as arising in the portio. Probably some of the differences are due to the absence of a common understanding as to the definition of



Fig. 312.—Early squamous carcinoma of the cervix.

the cervical divisions to which reference is made. There can be little doubt that most cervical cancers arise in the neighborhood of the os externum.

The two chief varieties of cancer are usually termed:

1. Squamous-cell carcinoma.
2. Adenocarcinoma.

Besides these, the following rare varieties are described: *Malignant adenoma*, only occasionally found, and *colloid cancer*, very rare. A few cases of *endothelioma* have been described, the disease originating in the endothelium of blood-vessels and lymphatics.

1. Squamous-cell Carcinoma of the Cervix (Epidermoidal Cancer).
—This growth almost always originates external to the os externum, though



Fig. 313.—Carcinomatous mass projecting from the cervix.



Fig. 314.—Excavation of cervix caused by carcinoma

sometimes internal to it. It is very rarely seen in the earliest stage, because at this time the disease does not cause any symptoms or signs which attract the woman's attention. It begins by causing a localized induration, which is usually slightly elevated above the surface. The nodule consists of a number of small papillæ, and, on section, has a yellowish-white, somewhat translucent appearance. As the disease progresses this surface becomes more broken up and may resemble a cauliflower or massed bunches of grapes in miniature. It may spread over a large area of the cervix and often involves the adjacent fornix vaginæ. Isolated nodules may sometimes be found in the vaginal wall at some distance from the main growth. At the same time it extends into the substance of the cervix and the parametrium. The cervix may thus become markedly altered and its normal relations destroyed. Increase in size is usually accompanied by breaking down of the cancerous tissue and ulceration, local infection areas being frequently noticed. The cervix may thus partially or entirely break down, a cavity being left with a hard, irregularly nodulated wall, covered with necrotic tissue and pus. In some cases the loss of tissue is followed by contraction and puckering.

Microscopic Appearance.—In the earliest stage there is a proliferation of the deeper cells of the surface epithelium, forming irregular columns which extend inward; they are round, oval, or irregular on transverse section. The protoplasm of the proliferating cells is small, the nuclei of adjacent cells being closely packed together. Variations in the size of the cells and number of nuclei are found. Sometimes giant-cells are found containing three, five, or more nuclei. The connective-tissue stroma between the columns shows small-cell infiltration.

In most cases epithelial pearls are found, but not nearly so frequently as in the skin epithelioma, owing to the absence or poor development of a stratum corneum on the cervix. The pearl consists of a concentric arrangement of cells, the outer of which are somewhat cubical or rounded, the inner flattened or irregular horny cells, many of which have lost their nuclei. The growth of the carcinomatous cells is marked by increase of chromatin; the latter may often be found in masses where the outline of a nucleus has been entirely lost.



Fig. 315.—Extensive excavation of cervix caused by carcinoma.

The cells multiply chiefly by indirect nuclear division. Asymmetric and multipolar mitoses are frequently noted. The surface projections consist of a core of delicate connective tissue with thin-walled blood-vessels, and, externally, layers of epithelial cells, which vary in size.

As breaking down occurs the surface is covered with necrosed tissue, blood, fibrin, leukocytes. The latter penetrate the epithelial nests or columns, separating the cells, which then tend to undergo hyaline degeneration, the nuclei becoming irregular and vacuolated. Pus-formation in small areas may thus become quite noticeable.

2. Adenocarcinoma or the Cylindric-cell Variety.—This form may develop from any part of the surface epithelium lining the cervical canal, or the glands opening into it. It usually begins as a small nodule in the mucosa, which gradually increases on the surface, though in some cases it may early extend deeply into the tissues. The growth is usually elastic, friable, vascular, and whitish-yellow or pink in color. It may develop to a considerable extent above the os externum before any change in the vaginal portion of the cervix is visible to the naked eye. When the disease burrows into the cervix, the latter may become considerably swollen; this is partly due to venous congestion, owing to blocking of some of the veins. Rarely the cervix may be so interfered with as to cause the retention of fluid in the cavity of the uterus above. In some cases the growth may project from the surface as a cauliflower mass. The diseased part has a succulent appearance, whitish or pale yellow on section; degenerated areas are usually darker. The cancerous tissue is most vascular and friable at the edge, which is somewhat irregular, but generally well-defined. Necrosis and ulceration are very common.

Microscopic Appearance.—The disease may start in the surface epithelium or in that lining the cervical glands. There is a multiplication of the cells, which form projections. These may blend within the folds of the cervical mucosa or the lumen of a gland, dividing the latter into many small spaces; frequently it is difficult to find remains of the original lumen. Little or no proliferation of the connective tissue takes place. When a cauliflower projection is examined, it is found to be composed of branching papillæ consisting of a connective-tissue stroma covered with several layers of epithelial cells. Cullen states that the stroma is more abundant and the blood-supply less marked than in the corresponding projections of squamous-cell carcinoma, so that they do not break or bleed so easily. The proliferated cells in adenocarcinoma vary in shape, the outermost ones being usually columnar, the others being mostly polyhedral or somewhat flattened. They are easily detached. The nuclei are usually larger than those of the normal cells, more than one being frequently present; they are also richer in chromatin. Vacuolation is often noticed. R. Williams points out that multiplication takes place mainly by indirect nuclear division. The nuclei often shed their chromatin into the surrounding protoplasm prior to division. Asymmetric and multipolar mitoses and abortive mitoses are frequent. Fatty, caseous, mucoid, and other degenerations are common in the cells, colloid and calcareous changes being very rare.

Small-cell infiltration may be found in the stroma or between and in the cancer-cells; nonstriated muscle-cells may be found in the stroma. The mu-

cosa of those portions of the uterus not affected by carcinoma is usually somewhat thicker than normal, but whether this change was present before the development of the cancer or is induced by the latter is uncertain. Sometimes distinct localized projections are found, which must be distinguished from cancerous metastases.

Malignant Adenoma.—This rare form of malignant disease has been reported by several observers. The epithelial proliferation is mostly glandular in type, the growth being composed of closely packed, gland-tube spaces lined with a single layer of columnar epithelium. In some of the cases

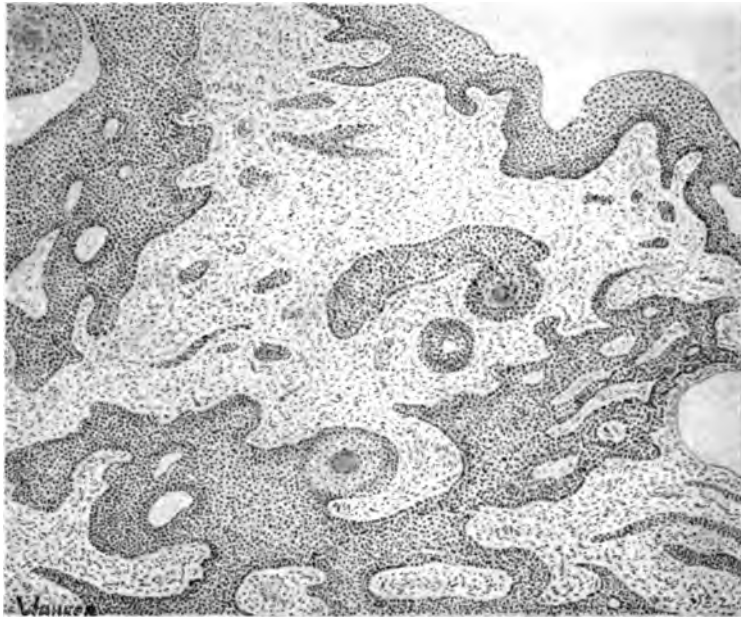


Fig. 316.—Squamous carcinoma of cervix ($\times 27$).

described the adenomatous structure was not everywhere present, there being at certain points masses of epithelium several layers in thickness.

Metastases are similar to the primary growth.

Colloid Cancer.—This variety of carcinoma is extremely uncommon. R. Williams thinks it probably arises only from aberrant “rests” derived from the ovary or from the intestinal mucosa. He points out that myxomatous new-growths of the uterus, having a gelatinous appearance, have been wrongly described as colloid.

Endothelioma.—This rare variety has been found in the cervix several times. The new-growth arises in the endothelium of blood-vessels or lymphatics. In one case it occurred in a girl of eighteen, and formed a bleeding papillary growth. The disease spreads locally, invades lymph-glands, and forms metastases.

EXTENSION.

Extension of Cancer of the Cervix.—The disease extends into the musculature of the cervix and early tends to invade the vaginal vault, especially anteriorly. Independent nodules may develop from detached cancer-cell masses carried in lymphatics. Portions may also be found in veins. The surrounding parametric tissues, especially the broad ligaments, are invaded directly and by the lymphatics. Wakefield says that involvement of the parametrium probably always precedes glandular involvement, and that extension may sometimes travel along nerves. In Wertheim's 80 cases the parametrium was invaded in 45. In many cases affected tissue may be recognized by its thickness, but often the finger cannot detect any deviation from the normal, though the parametrium be involved. Moreover, parametric thickenings in association with carcinoma uteri may be simple in character. It is impossible to be accurate concerning the tissue, except after microscopic study. There is no definite relationship between the primary cancer and parametric invasion. A large uterine growth may sometimes be associated with noninvolvement of the parametrium, whereas the latter may be invaded when the primary growth is very small. The uterosacral ligaments and the connective tissue in front of the cervix are less frequently involved. Extension upward into the corpus uteri may also occur; sometimes this is direct, sometimes by dissemination.



Fig. 317.—Finger-like projections in squamous cancer of cervix ($\times 55$).

As the disease advances the bladder, urethra, ureters, rectum, vagina, peritoneum, intestines, etc., may become involved. The ovaries and tubes are rarely affected. The bladder and urethra may be involved by direct invasion from the cervix, or the latter may be affected by vaginal metastatic growths. Cystitis may develop, and infection may extend to the ureters and kidneys. Necrosis of the cancerous tissue may lead to the formation of a vesicovaginal fistula. The ureters may be compressed by the growth, but direct invasion of their wall is not common, the sheath having some protective influence. Complete obstruction is rare; dilation of the ureter and pelvis of the kidney and degenerative changes in the latter may follow.

The rectum may be invaded by direct extension through the pouch of Douglas; this is most likely to occur when the uterus is retroverted. Or it may follow involvement of the parametrium or posterior vaginal wall. Necrosis of tissue may lead to a communication between the rectum and genital tract. The vagina may be invaded directly from the cervix or by implantation. The pelvic bones are rarely affected. General peritonitis seldom

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occurs. Sampson states that in the so-called operable cases the pelvic glands are involved in from 30 to 50 per cent.

Involvement of Lymph-glands.—Various groups of lymph-glands may be affected in cancer of the cervix, the first being usually those which are immediately related to the primary seat of disease. Others are involved from areas to which the original cancer spreads, while each gland affected forms a new center of dissemination. There is good reason for believing that a large number of cancer-cells carried in lymphatics are destroyed in the lymph-glands. Were this not the case, gland enlargements would be much more frequent and extensive than they actually are. In the great majority of cases the disease is found in lymph-glands, though frequently the involvement is not appreciable to sight or touch, and is not common in the early stages of cancer. The iliac glands are most frequently directly involved, those that are situated in the bifurcation of the common iliac artery forming the upper portion of this group, as well as those placed internal to the great sacrosclatic foramen, close to the great sacrosclatic nerve. Cruveilhier states that the latter are often the only ones involved in cancer of the cervix. Next above the iliac group are the lumbar glands, which may also be involved by upward extension from the iliac. The sacral and hypogastric glands may also be affected.

Ries has made a very thorough study of lymphatic involvement in cancer of the cervix, and points out that cancer is found in the lymph-glands with great variations. It may be found in the afferent vessels outside the gland-tissue proper, having been carried from the primary lesion. It may be found penetrating the connective tissue of the hilum of the gland; invasion of one

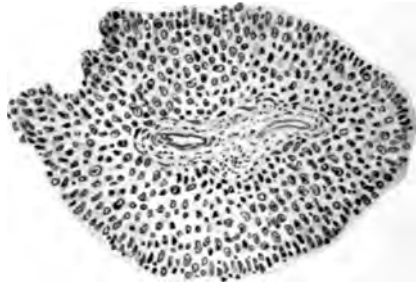


Fig. 318.—Cross-section through finger-like projection in squamous cancer of cervix ($\times 53$).

or more follicles or medullary cords may be noticed; or, in the most advanced condition, the whole gland may be replaced by carcinomatous tissue. The altered glands may contain cysts containing blood or degenerated cancerous cells. Hyaline or calcarous degeneration may be found in cancerous as well as in noncancerous glands. Ries points out that the carcinomatous gland is not always enlarged, and that an enlarged gland is not always carcinomatous. He notes that in examining glands epithelial tubes may occasionally be found which may be mistaken for carcinoma. They are usually small, situated in the capsule of the gland, following the trabeculæ. Sometimes they may be large and extensive, extending into the gland-tissue, but always following the trabeculæ, not invading the lymphatic tissue, as does carcinoma. These tubes, composed of cubic or columnar cells in one layer, surrounded with connective tissue, are probably derived from remains of the Wolffian body which have been embedded in the lymphatics. In some cases in which there is no carcinoma, large cells resembling cancer-cells may be found, the nature of which is not certain, *e. g.*, they have been noted in tuberculosis.

Ries has also pointed out the existence of hemolymph glands in the pelvis

and states that carcinomatous invasion of these may lead to dissemination in the blood-stream.

Rarely the inguinal glands are enlarged. This may be due to an extension from the iliac group by the lymphatics passing along the iliac vessels through the crural canal. Also in cases of involvement of the body of the uterus transmission may take place along the round ligament.

Occasionally the mesenteric glands, and, rarely, the mediastinal glands, are affected. More rarely may be found with uterine cancer what Troisier and others have demonstrated in connection with carcinoma in various other organs, viz., involvement of glands at a distance without invasion of intervening structures. The left supraclavicular glands are most frequently affected; rarely, the right supraclavicular, the axillary, epitrochlear, etc. R. Williams explains this by regurgitation from the thoracic duct of lymph containing cancer-cells which have been carried by lymphatics from the primary area of disease.

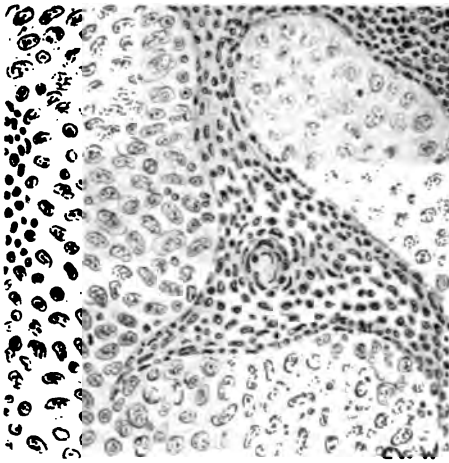


Fig. 319.—Cancer of cervix—squamous ($\times 265$).

containing cancer-cells which have been carried by lymphatics from the primary area of disease.

The relationship of parametric to gland involvement is interesting. In Wertheim's 80 cases both were absent in 32. In 22 the parametrium was involved while the glands were free. In 18 cases both were involved. In 4 the parametrium was not involved on either side, the gland being cancerous on one side; in 3 other cases the parametrium was invaded on one side and the gland on the other, while in another the parametrium on one side and the gland on both sides were cancerous.

Winter has collected 68 cases of the total radical abdominal operation in which carcinomatous glands were found in 35 per cent.

Different opinions are expressed as to the glandular involvement in cancer of the vaginal portion and of the upper part of the cervix. The author holds to the statement of Cullen that in early cancer of the vaginal portion the glands are rarely involved, and that the disease must extend well out into the broad ligament before the lymphatic glands can be invaded.

In studying the condition of the glands it is important to remember that cancer-cells may be found, though there is no enlargement; also that enlarged glands may not be cancerous. Gland-swellings may be caused by extension of various infecting organisms and toxins from an ulcerating cancerous surface, and hypertrophy may be due to other associated conditions. There is no fixed relationship between the size of the primary growth and the presence, absence, or degree of lymphatic involvement.

Metastases.—The liability to general dissemination from cancer of the uterus is not great. R. Williams has found it in only 20 per cent. of cases

which have been fatal, whereas he places it at 73 per cent. in mammary cancer. The explanation is probably to be found in the comparatively rapid growth of uterine cancer, metastases tending to occur in the late stages. The metastatic growths are carried in the blood-stream. In R. Williams' 79 necropsies, metastases were found—

In the lungs (both 6, right 1).....	7 cases.
“ “ liver.....	7 “
“ “ peritoneum and omentum.....	4 “
“ “ pleura (both 1, right 1).....	2 “
“ “ skin of chest and abdomen.....	1 case.
“ “ tibia and innominate bone.....	1 “
“ “ heart.....	1 “
“ “ kidney.....	1 “

They have also been described in the stomach, mamma, brain, gall-bladder, thyroid, adrenals, and elsewhere.

SYMPTOMS.

Local Symptoms.—The disease is usually quite insidious at first. It may be considerably advanced before the patient notices that anything is wrong. Hemorrhage is generally the first-noted symptom, and may appear when the woman is apparently in perfect health. It may be a mere trace, noticed after coitus, defecation, or some other form of exertion. In these cases probably the blood comes from the bursting of capillaries in the remains of the mucosa covering the growth, or from laceration of the friable cancerous tissue. Sometimes it arises from ulceration. Sometimes the menstrual period is noticed to be rather profuse. Metrorrhagia may develop. In the late stages of the disease hemorrhage is not prominent unless the wall of a large vessel is ulcerated through.

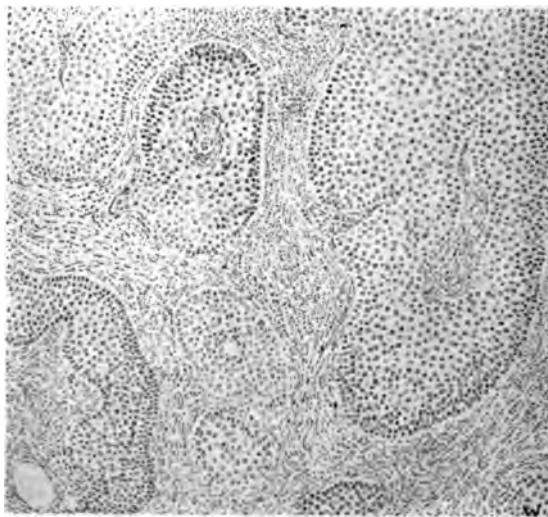


Fig. 320.—Adenocarcinoma of the cervix ($\times 78\frac{1}{10}$).

Leukorrhea is a prominent feature usually. At first this has the ordinary characters found in connection with endometritis. In the squamous-cell variety there is frequently an early profuse watery discharge.

When ulceration has occurred and decomposition of the necrosed tissue has set in, the characteristic discharge with its fetid smell is produced. It is variously colored, being yellowish-white, brown, green, or bloody. It is made up of serum, mucus, broken-down tissue in a state of necrosis or fatty degeneration, pus-cells, more or less blood, fibrin, and colonies of micro-organisms.

Pain is often present in cancer; in some cases it is hardly noticeable throughout the whole progress of the disease. It rarely occurs in the first stages, but usually later, when infiltration of the uterine wall and of the parametric tissue is taking place.

When branches of the sacral plexus are involved, the pain may be very intense. It is often again lessened when much breaking-down of the growth occurs.

The pain varies in character; it may be felt in the lumbar regions, in the pelvis, and shooting down the legs. It is dull and gnawing, or sharp and cut-

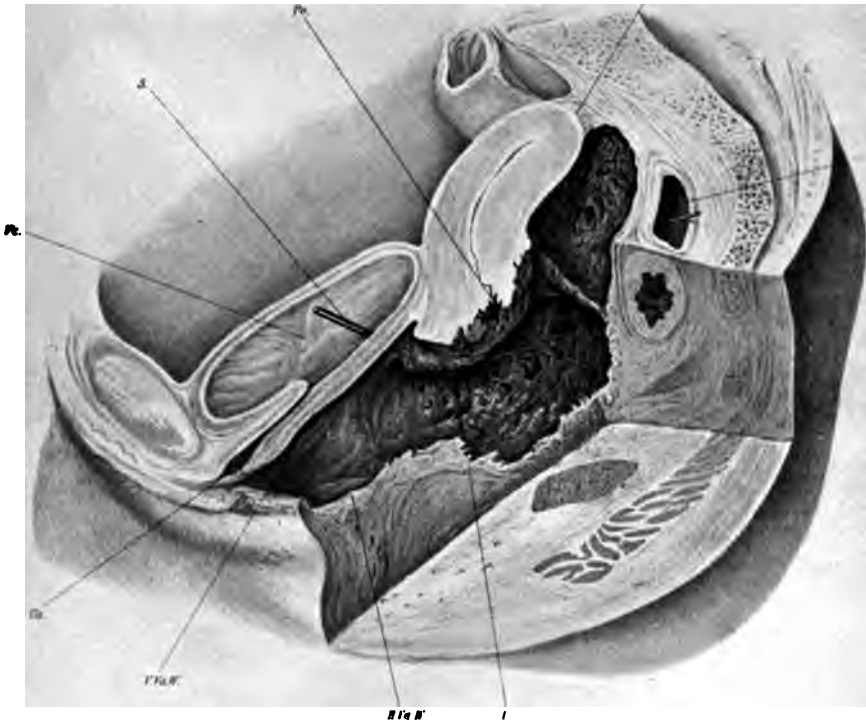


Fig. 321.—Ureteral fistula in carcinoma of the uterus (sagittal section): *H.V.a.W.*, Posterior vaginal wall; *Po.*, vaginal portion of uterus; *R.*, rectum; *S.*, sound in ureter; *U.*, ureter; *U.a.*, urethra; *V.c.*, bladder; *V.V.a.W.*, anterior vaginal wall (Tandler and Halban).

ting. Sometimes the pains met are mainly due to peritonitis, ovaritis, or salpingitis, in which case there is usually some rigidity of the abdomen and tenderness on palpation. Various reflex and sympathetic pains are often found, *e. g.*, in the mammae. Pain in the lower limbs is in some cases associated with thrombosis of veins.

General Symptoms.—In the early stages the patient may show no sign of ill health. There is a gradual loss of weight and strength, failure of appetite,

and a sense of fatigue. Neuralgic pains and headache are often present as the patient weakens. Sleeplessness, depression of spirits, and irritability are very frequent. Peripheral neuritis may develop. Various symptoms associated with sympathetic nervous disturbances may be present, *e. g.*, alternate congestion and pallor of the skin, especially of the face and hands. There may be marked sensitiveness to cold. Brown patches may appear on the face and neck. Elevation of temperature is not common, and is due to septic absorption at the primary seat of the cancer, or to associated inflammation in other parts; in the advanced stages of the disease there is frequently a subnormal temperature. As the disease advances, anorexia, dyspepsia, nausea, vomiting, meteorism, and constipation become marked. Then the so-called "cancerous cachexia" develops. The skin assumes a yellow color, probably due to copremia, and it is also usually harsh and dry. There may be cystitis and disturbances of micturition and difficulty on defecation. If vesical or rectal fistulæ are present, the discharges escape by the vagina. Frequently the skin in the vulvar region is much irritated, and erythema, eczema, prurigo, or excoriation may be marked.

In some cases there are periodic attacks of subacute uremia. As the disease progresses this tends to become chronic, and the patient becomes dulled in intelligence and sensibility, so that toward the end a semicomatose condition often develops, during which no pain may be felt.

Death may occur quietly while in this condition. Uremia with convulsions is not often met. Death from peritonitis with or without perforation is rare. The latter and embolism may cause sudden death. Often it may be solely due to the general blood-poisoning, or sometimes to hemorrhage or as a result of venous thrombosis.

Occasionally, cases of carcinoma are met which pursue an atypical course, all or some of the ordinary symptoms being for the most part absent or slightly marked until the late stages of the disease. In the author's experience such varieties are most frequent in cases in which the disease develops several years after the menopause. Sometimes there may be no symptom until the cancer has extended widely, involving the bladder, ureters, or rectum. In one case a large mass of adenocarcinoma developed in the pelvis, there being neither hemorrhage nor discharge; the patient sought advice only on account of frequency of micturition. In another case the patient first developed uremic symptoms, due to involvement of the ureters by the carcinoma, whose presence had not previously been suspected.

Physical Signs.—The physician rarely has an opportunity to determine these in the earliest stages of carcinoma, since patients seldom seek advice until the disease is more advanced. Usually, the cases which are recognized most early are those in which the disease begins external to the os externum. A localized hardness may be felt, and this may be raised slightly above the surface. Frequently there is a tumefied appearance of the cervix in the region of the growth. Very early the mucosa may be thinned or eroded over the cancerous nodule, and the latter may present a granular appearance. One of the earliest signs is bleeding on examination, due to the rupture of capillaries in the mucosa over the cancer or to breaking-down of the latter. When the disease begins internal to the os externum, the primary nodule is rarely seen or felt, though it may be if the os is patulous. In later stages the

cervix presents various appearances. Papillary outgrowths and eroded or ulcerated areas may be seen and felt. Excavated portions have irregular edges and walls, which are usually nodulated. The cervix may be largely destroyed, and nodules of the disease may be felt in the vaginal fornix. When the examining finger is withdrawn, it is usually bloody and foul-smelling.

To determine whether or not the disease has spread beyond the uterus the fornices should be carefully palpated for areas of infiltration, and the mobility of the organ should be ascertained by bimanual manipulations. It must always be remembered that in many cases the disease may have extended into the parametrium though the finger may feel no thickening in this region; also that thickened areas may only be inflammatory in character. When the disease communicates with the bladder or rectum, the fistulous opening may be felt or seen.

DIFFERENTIAL DIAGNOSIS.

The following conditions must be distinguished from carcinoma cervicis:

1. *Catarrhal Patches, Erosion, Ectropion.*—In inflammatory conditions of the cervix leading to the production of red catarrhal patches on the vaginal portion of the cervix there may be a resemblance to early carcinoma. The catarrhal patch sometimes bleeds on being pressed by the finger-nail, but never freely. If the cervix be steadied with a volsella and an attempt be made to scoop out a piece of the tissue with a curet, little or none can be obtained, whereas in cancer a definite portion may usually be removed. On microscopic examination the red catarrhal patch is found to be covered with a single layer of columnar epithelium, even when the papillary form of erosion exists. There is no multiplication of the epithelium forming layers.

2. *Laceration of the Cervix.*—A gaping lacerated cervix with exposure of the mucosa lining the canal may simulate carcinoma. On approximating the lacerated edges the everted mucosa disappears. If a portion of the latter be examined, it is found to have the structure of the cervical endometrium. It does not usually bleed on examination.

3. *Hypertrophy of the Cervix.*—In chronic enlargement of a part or the whole of the cervix all the tissues are hypertrophied. The papillæ of the squamous epithelium may be larger than normal, but there is no extension of the epithelium downward, nor excess of chromatin.

When the cervix is nodulated, due to the presence of Nabothian follicles, there may be a closer simulation of cancer. The cervix does not, however, tend to bleed, and is not friable. Puncture reveals the cystic character of the nodules, and the cysts are shown by the microscope to be lined by a single layer of epithelium.

When the Nabothian follicles are associated with superficial catarrhal patches, the naked-eye resemblance to malignancy may be close, and the hardness of the follicles when palpated by the fingers may simulate the hardness of cancerous nodules.

4. *Cervical Mucous Polyp.*—One or more mucous polyps growing from the cervical endometrium may cause irregular losses of blood. The polyp may or may not project through the cervix, and bleeds easily on examination. It has usually a narrow pedicle, and if studied microscopically, is found to be covered by a single layer of columnar epithelium, though sometimes, when it

grows close to the os externum, it may in part be covered with stratified squamous epithelium. In its substance sections of glands are found, the polyp being, indeed, a local hypertrophy of mucosa of inflammatory origin.

5. *Ulcerated or Sloughing Fibroid Polyp*.—A fibroid polyp lying in the cervical canal and stretching it may be easily mistaken for advancing carcinoma, especially if closely embraced by the cervical ring, because of the hemorrhage, tissue necrosis, and foul discharge which are present. Careful examination reveals the polypoid character of the mass, while portions removed and studied under the microscope reveal no carcinomatous tissue.

6. *Tuberculosis of the Cervix*.—The symptoms of uterine tuberculosis may closely resemble those of carcinoma, hemorrhage being usually a less marked feature. The ulcers are generally well-defined, the edges being undermined; the base is studded with nodules and covered with yellow pus or caseous matter. There is not usually the induration of carcinoma. Microscopically, giant-cells and tubercles are found.

7. *Syphilis*.—Primary chancre of the cervix is rare. It is usually a solitary, shallow ulcer with induration; it does not easily bleed, and forms little discharge. On microscopic examination no resemblance to cancer is found.

Secondary syphilids occur as condylomata or erosions. They are usually multiple and not indurated. Other secondary manifestations are generally present.

Tertiary gumma, infiltration, or ulceration is rare, and may simulate cancer closely, especially when there is much breaking-down of tissue. The microscope is necessary to exclude carcinoma.

8. *Diphtheric Patch*.—A cervical diphtheric infection may produce an appearance simulating a sloughing malignant area. Elevation of temperature and other systemic disturbances and culture usually suffice to establish the true nature of the trouble. It usually disappears rapidly under the use of antidiphtheric serum.

9. *Sarcoma of the cervix* is very rare. The rapidly growing soft growth may form polypoid, grape-like masses, which are easily detached. Their nature is soon established by the microscope. The circumscribed or diffuse, slow-growing forms gradually produce enlargement, hardening, and fixation of the uterus, but usually require to be studied under the microscope in order that their nature may be established.

10. *A retained portion of placenta or membranes* lying in the cervical canal, especially if associated with hemorrhage, necrosis, and infection, may simulate cancer. The history of a recent pregnancy and elevation of temperature should suggest the true condition, which may be decisively determined by the use of the microscope.

11. *Various Diseased Conditions of the Corpus Uteri*.—Fungous endometritis, fibroid, malignant disease, and other affections of the corpus uteri which cause hemorrhage or foul discharge or both may be mistaken for malignant disease of the cervix. To differentiate between them it is necessary to make a careful bimanual examination and to explore the interior of the uterus, dilating the cervix for this purpose if necessary.

PROGNOSIS.

Variations are found as regards the rapidity of the progress of cancer of the cervix. R. Williams found the duration of life in 90 fatal cases as follows:

Under 6 months in 4 cases.				From 36 to 42 months in 5 cases.			
From 6 to 12 months in 20 cases.				" 42 to 48 " " 4 "			
" 12 to 18	"	" 22	"	" 48 to 54	"	" 2	"
" 18 to 24	"	" 13	"	" 54 to 60	"	" 1	case.
" 24 to 30	"	" 10	"	" 60 to 66	"	" 1	"
" 30 to 36	"	" 6	"	" 66 to 102	"	" 2	cases.

The average duration of the disease from the time symptoms are first noted is something between fifteen and twenty months. It is greater in those cases occurring after the menopause than in those developing in earlier life. In the latter some cancers run a very acute course, which is rare in women over sixty. Kiwisch has reported one which lasted only five weeks; Martin, one which was fatal in nine weeks; H. Morris, one in which the total duration was four months. In the last-mentioned case there was general dissemination throughout the body. The average duration of carcinoma of the cervix is not so great as in cancer of the corpus uteri. The percentage of cases which last more than three years is not great—16 per cent. according to the experience of R. Williams. Several instances have been noted in which the disease lasted five, six, seven, or more years. F. Barker has reported a case in which the duration was eleven years. Some of these rare chronic cases may be marked by a partial healing of the destroyed normal tissues, the granulations gradually leading to cicatrization. Such cases may run a fairly dry course. Spontaneous disappearance or cure does not, however, take place.

Lomer states that anemia, exhausting disease, and febrile conditions in patients with cancerous disease tend to retard the development of the latter.

TREATMENT.

Cancer of the cervix can be successfully treated only by removal of the entire disease. Various methods of accomplishing this have been proposed, and there is at the present time a difference of opinion as to the most satisfactory. Until thirty years ago the disease was generally regarded as hopeless, and palliative operative measures only were carried out, *e. g.*, removal of the cancerous tissue with knife, scissors, écraseur, cautery, caustics, etc. At various times in the nineteenth century removal of the entire cervix was proposed and carried out, but it was not until Schroeder advocated this procedure in 1878 that it became widely practised. Owing to researches in recent years concerning the lymphatic distribution in the uterus and other pelvic tissues and to the unsatisfactory results of Schroeder's operation as regards recurrence of the disease (in all cases except the very few in which the disease was early and limited to the vaginal portion), more extensive surgical procedures have taken the place of the amputation of the cervix, which has been relegated to the category of measures which are regarded only as palliative.

Extirpation of the entire uterus is now the favorite procedure in cases in which the disease is believed to be early and limited to the cervix. (Freund

recommended abdominal removal in 1878, but the operation never became popular, as the mortality in the early years was more than 30 per cent.) Vaginal extirpation took its place, and has been the favorite procedure ever since. Recently, however, the abdominal operation has been coming into favor, as a result of the advocacy of Ries, Wertheim, Clark, and others. These workers have insisted upon the necessity of removing more than the uterus, even in cases in which the disease seems to be early and limited to the cervix. They advise a wide removal of the cellular tissue and pelvic glands to which the cancer-cells are usually carried by the lymphatics, and hold that this extensive procedure can best be carried out by the abdominal route.

Schuchardt has, however, advocated vaginal extirpation combined with a vaginoperineal or so-called paravaginal incision, for the purpose of obtaining a large opening through which extensive removal of tissue may be carried out. This operation has not yet been very widely practised.

The latest tendency is undoubtedly in the right direction. The free lymphatic anastomosis between the cervix and body of the uterus, more abundant, as Seelig has shown, in the musculature than in the mucosa, must entirely exclude mere amputation of the cervix in early carcinoma of this part of the uterus from the category of radical procedures. It has been shown that the whole uterine lymphatic system may be injected by a syringe introduced into almost any part of the uterus.

Observations regarding the frequency with which cancer recurs in the scar after total extirpation of the whole uterus, and the microscopic study of the cut surface of parametric tissues at the time of this operation, as well as of lymphatics and glands within the pelvis, revealing cancer-cells at various distances from the uterus, have caused much skepticism as to the value of removal of the uterus alone, whether the vaginal or abdominal route be selected. Indeed, some authors, while admitting that there may be no recurrence after this operation in a small percentage of cases, hold that for the great majority of cases it is valuable only as a palliative measure. It is well known, of course, that the after-results of this operation are the better the earlier the disease in the cervix, yet it is also known that there is no clinical method of determining when it is limited to this structure. There can, therefore, be no doubt that the operation which is likely to be followed by the smallest percentage of recurrences is abdominal removal of the uterus, ovaries, tubes, broad, round, and uterosacral ligaments, upper part of the vaginal wall, adjacent parametric and paravaginal tissues, lymphatic glands situated between the external and internal iliac vessels, over the great sacrosclatic foramen near the great sciatic nerve, and those near the common iliac veins which receive the lymphatics of the uterosacral ligaments. The mortality associated with this extensive procedure is undoubtedly greater than that in simple extirpation of the uterus, and the length and tediousness of the procedure have undoubtedly deterred many operators from performing it. Yet there is every reason to believe that experienced and expert gynecologists will soon reduce the time of this operation and thereby reduce the death-rate accompanying it.

It is unfortunate that in the great majority of cases in which the disease is first diagnosed it has advanced too far to be removed. The percentage of operable cases varies in different clinics, though in general it has gradually

increased in recent years. Thus Winter reported it before 1892 at 28.7 and since at 48; Pfannenstiel before 1897 operated in 28.6 per cent., and afterward in 35.4. Some operators have quoted very low figures, *e. g.*, Baecker, 10 per cent.; Akontz, 13.3; Schauta, 14.7; in the author's experience, about 11 per cent.

A larger proportion of cases in which the disease starts in the cervical canal are inoperable than of those in which it begins in the vaginal portion.

In the case of cancer of the body the percentage of operability is higher. Krukenberg reported it as high as 62.3 per cent. in his experience.

I shall now describe in detail the various radical procedures to which reference has been made.

TOTAL EXTIRPATION OF THE UTERUS.

A. BY THE VAGINAL ROUTE.

This operation can be satisfactorily carried out only when the vagina is not too small. When more room is desired in any case, the vagina should be dis-



Fig. 322.—Vaginal extirpation of uterus. The dotted line indicates the first incision made.

tended with rubber bags during the two or three days previous to operation. Sometimes it may be necessary at the beginning of the operation to divide the perineum a short distance external to the middle line on each side, in order to obtain more room. Care must be taken, however, to prevent contamination of these wounds with cancerous tissue; they should be carefully closed with sutures at the end of the extirpation. In some cases it is advisable to catheterize the ureters before operation, in order that the latter may be easily recognized. This is advisable when the normal relationships are much disturbed, especially when the extent of the carcinoma is uncertain.

The patient is prepared for the operation as described on p. 217. If there

are ulceration and breaking-down of the carcinoma associated with foul-smelling discharge, it is advisable to scrape away as much as possible of the diseased tissue three or four days prior to operation, at the same time applying the actual cautery and pure formalin. Thereafter strong antiseptic douches (30 min. formalin to 1 pint water) should be given two or three times daily until the day of operation. If there is no tissue-necrosis, this preliminary treatment is not necessary. It is sufficient to apply strong formalin to the interior of the uterus if the disease be entirely within the os externum at the time of the operation. If it projects beyond the os, the tissue should be scraped with a curet and then cauterized, formalin being applied to the interior of the uterus. In every case the cervix should then be thoroughly closed with a continuous suture in order to prevent the escape of any shreds or discharge during the manipulations. All detached portions of carcinoma should be carefully washed out of the vagina with an antiseptic lotion in order to diminish the risk of implantation.

A clean perineal sheet should then be placed in position.

The cervix is then pulled downward with a strong volsella. A circular incision is made through the mucosa at the level of the fornix, and is extended laterally on each side for three-quarters of an inch. This incision may require to be irregular, according



Fig. 323.—Vaginal extirpation of uterus. Dissection upward of mucosa from vaginal portion of cervix.

to the situation of the carcinoma; it should be more than half an inch from the outer edge of the latter. The handle of a knife or a dissector is then inserted into the incision in order to push up the fornix, loose connective tissue being divided. Great care especially is taken in stripping up the anterior portion to keep close to the uterine wall, in order that the bladder or ureters may not be injured. When the carcinoma affects the anterior wall of the cervix, the risk of wounding these structures is greatest, owing to the operator's desire to keep away from the diseased area.

The bladder should be pushed up until the reflection of the peritoneum from this viscus to the uterus is reached; it should then be divided transversely.

A couple of fingers are introduced in order to stretch the opening widely, a rapid exploration of the pelvis being at the same time made.

The edge of the peritoneum covering the bladder is then pulled down and stitched to the mucosa of the anterior fornix by means of three or four catgut sutures.

The cervix is then drawn upward and forward in order to give easy access to the posterior fornix. The posterior vaginal wall is pushed upward from the line of the original circular incision and the lower part of the pouch of Douglas entered by a transverse incision, the knife or scissors being held at right angles



Fig. 324. Vaginal extirpation of uterus. Opening made into peritoneal cavity, between the uterus and bladder.

to the cervix. Fingers are introduced in order to stretch this opening widely. There may be considerable bleeding from the edges, and it is best to apply four or five interrupted catgut sutures in order to check hemorrhage and to approximate the peritoneum to the mucosa of the posterior vaginal wall. One or two gauze pads are then introduced into the pelvic cavity; to the tapes attached to them forceps are fastened in order that they may be easily found. The cervix is then pulled directly downward and a retractor placed in the hand of an assistant. The uterine vessels are then exposed and ligated with anterior peritoneal opening, so that the bladder may be well elevated by the catgut, first on one side and then on the

other, about three-eighths of an inch outside the cervix, a long-handled pedicle needle being used to carry the catgut. The ligament is then divided between the ligature and the cervix nearly as high as the level of the os internum.

The anterior wall of the uterus is then grasped with one or more volsellæ and pulled down while the cervix is pushed upward in the vagina. In this way the fundus is made to appear in the vagina. A finger is then introduced into the pelvis in order to free the tubes and ovaries from adhesions if any are present.

Another gauze pad may now be introduced into the pelvis to prevent the prolapse of omentum or intestine and to absorb blood which escapes.

The broad ligament of one side is then to be clamped with strong forceps from above downward and is divided between the forceps and the uterus so as to free the latter entirely on that side. The uterus is then pulled down as far as possible, in order that the other broad ligament may be ligated and divided. The upper catgut ligature is applied to the infundibulopelvic ligament controlling the ovarian vessels above the tube and ovary. The others secure the rest of the broad ligament as far down as the ligatures previously applied to the uterine vessels. The uterus, tube, and ovary are then removed.

The forceps applied to the other broad ligament are then drawn downward in order that ligatures may be introduced and tied, corresponding to those placed on the opposite ligament; the tube and ovary are then removed.

The ends of all the ligatures on each side are then massed together in a leash, and the broad ligaments carefully examined for bleeding points; if any are found, they may be controlled by other ligatures.

The stump of each broad ligament is next fastened into each lateral portion of the opening in the vagina, so that the raw ends and the ligatures lie outside the peritoneal cavity. This

is accomplished most satisfactorily as follows: The stump is gently drawn down by an assistant on one side, while a strong catgut suture is introduced with a full-curved needle through the edge of the vaginal wall both in front and behind, including the peritoneum of the broad ligament just above the stump. A corresponding suture is similarly introduced on the opposite side. These sutures are then tied, so that the broad ligament is compressed in each lateral angle of the vaginal opening. In order to hold the ligament securely in position another suture is passed on each side through the edge of the vaginal opening and the stump.



Fig. 325.—Vaginal extirpation of uterus. Opening into peritoneal cavity behind cervix.

The gauze pads are then withdrawn from the pelvis, and the latter is washed out with hot salt solution. The vaginal opening between the stumps is next closed with a fine running catgut suture, care being taken to approximate the peritoneal surfaces. The ends of ligatures are then cut short and the vagina packed with chinosol gauze. The patient is catheterized in order to determine whether urine has accumulated in the bladder during the operation.

Variations in Technic.—Occasionally it is advisable to vary the procedure just described. Thus, in some cases it may be convenient to open the peritoneum posteriorly before entering it in front. It may be necessary to do



Fig. 326.—Vaginal extirpation of uterus. Ligation of left uterine vessels.

this when there is difficulty in finding the reflection of the peritoneum in front or when there are adhesions between the bladder and the anterior wall of the uterus. Sometimes the uterine vessels cannot be easily isolated so as to be ligated, and it may be necessary to secure them in mass ligatures placed in the broad ligaments. In some cases the fundus cannot be pulled down on account of adhesions, enlargement of the uterus, or smallness of the vagina, and it may be necessary to ligate the ligaments in stages from below upward, the uterus being gradually pulled down and cut away from its attachments. Occasionally it is more convenient to pull the fundus down behind than in front before securing the broad ligaments. In

cases in which the uterus is prolapsed, on pulling the fundus down the tubes and ovaries may be so easily accessible as to permit the ligation of the broad ligaments from above downward without previous application of clamps and separation of the uterus on one side. When, in the course of the operation, an infected area is exposed, *e. g.*, rupture of a pus-tube (which is not known to be sterile), it is advisable at the end of the operation not to close the vaginal opening between the stumps, but to pass the end of the chinosol gauze through it in order that drainage may be kept up for two or three days.

It is rarely necessary to split the uterus in removing it. Indeed, this procedure is, in general, contraindicated, because of the risk of transplanting portions of the carcinoma.

Complications of the Operation.—The bladder may be torn or cut; if the injury be recognized, the opening should be closed with catgut. Sometimes it is not discovered and a vesicovaginal fistula results. Similarly, though very rarely, the rectum or an adherent piece of intestine may be injured. The ureter may be tied, cut, or torn. The injury is not usually discovered at the time of operation. Hemorrhage is sometimes troublesome, especially

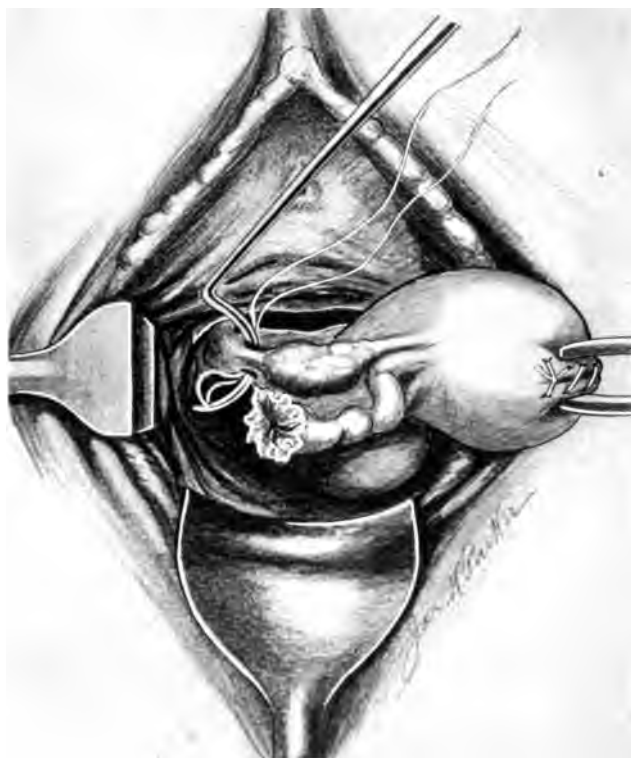


Fig. 327.—Vaginal extirpation of uterus. Ligation of ovarian vessels in outer part of broad ligament. The fundus is drawn down with forceps.

when the parametrium is invaded by the carcinoma. The ligatures may cut through the tissues and not secure the vessels. It is then necessary to apply forceps and leave them in position several days, or to place the patient at once in the dorsal position and perform abdominal section for the purpose of securing the vessels. This complication should rarely occur, for vaginal extirpation should not be performed if the parametric tissues are invaded by cancer. In 69 operations by Baecker injuries of ureters, bladder, or rectum were produced 9 times. Zweifel reported them as occurring in 4.8 per cent. of his cases. Reipen states that the rate was 8.91 per cent. in Kaltenbach and Fehling's

cases. Sampson states that in 156 hysterectomies for cancer of the uterus the ureters were accidentally injured 91 times.

Schuchardt's Operation.—One of the latest varieties of the vaginal method is that of Schuchardt. A vaginoperineal or so-called paravaginal incision is made through the lower three-fourths of the posterior vaginal wall, a little to the left of the middle line, extending downward around the rectum and anus to the coccyx. In this way a large opening is made, so that when a posterior spatular speculum is introduced and pressed toward the coccyx, ample room is obtained for the removal of the uterus, a large cuff of the vaginal wall, as well



Fig. 328. Vaginal extirpation of uterus. Appearance of vagina at end of operation. Stumps of broad ligaments are stitched into vaginal vault.

as parametric and paravaginal tissue. It is claimed that the ureters are easily found and separated from the parametrium. After the removal of all that is considered necessary, the vaginoperineal incision is closed with the exception of a small part that is drained with gauze. The pelvic wound is also drained through the vagina. This operation may be very difficult and sometimes, very prolonged. It has not yet been sufficiently tested to warrant recommendation.

Electrothermic Hysterectomy.—Downes has recently advocated this method in cancer of the uterus, because all tissue at the line of separation of the uterus is killed and all vessels sealed, little blood being lost in the operation.

Three angiotribes, varying in width, are needed, the electric current being used to give the required temperature. An electric cautery knife may as well be used in dividing tissues. Noble has recently recommended this method.

B. BY THE ABDOMINAL ROUTE.

Removal of Uterus and Adnexa Only. *Preliminaries.*—The patient is placed in the lithotomy posture and the vulva and vagina cleansed. If the

carcinoma extends beyond the os externum, it should be scraped away and cauterized. Formalin may also be applied to the uterine canal. The cervix should then be closed with a continuous suture. After the vagina is again cleansed, a tampon of chinosol gauze is placed against the cervix and the bladder is catheterized. The patient is then placed in the dorsal position and prepared for abdominal section. The operation is most satisfactorily performed in the Trendelenburg posture.

The Operation.—After opening the abdomen in the middle line gauze pads are introduced to form a barrier above the pelvic brim. The edges of the incision are retracted by an assistant. The upper part of each infundibulopelvic ligament containing the ovarian vessels is ligated with catgut. Each round ligament is ligated near the abdominal wall and is divided internal to the catgut; the uterine portions are then dissected away as far as the uterus. Each infundibulopelvic ligament is divided internal to its ligature, and the broad ligament cut horizontally under the tube and ovary. The latter are then compressed close to the uterus with forceps. Bleeding points in the broad ligaments are similarly controlled. The broad-ligament incisions are then joined by one which divides the peritoneum on the anterior surface of the uterus just above the bladder. The anterior layer of the broad ligament and the bladder are then stripped down until the uterine vessels are well exposed on each side near the uterus. These are traced nearly to their junction with the iliac vessels and ligated with catgut. The ureters are exposed in their course through the broad ligaments as far as the bladder, and the rest of the broad ligaments removed. The bladder is further stripped down from the cervix and upper part of the anterior vaginal wall. Through the latter the vaginal portion of the cervix and the vaginal gauze tampon are felt. The bladder is then pulled forward with a retractor and the anterior vaginal wall is divided below the level of the cervix with knife or scissors. The rest of the fornix vaginae is then divided with scissors, bleeding vessels being caught with forceps. The entire uterus is thus removed. Bleeding vessels are next secured with catgut. The peritoneum above the posterior part of the bladder is stitched to the anterior vaginal wall. The raw edges of the broad and round ligaments are buried with continuous catgut under the peritoneum, and, finally, the vaginal opening is closed and covered with peritoneum. The gauze sponges are removed, and the abdomen closed after being flushed with hot normal saline solution.

Variations in Technic.—When the cervix cannot be thoroughly scraped and closed prior to the abdominal incision, Ries' method of dissecting up a circular cuff of vaginal mucosa near the cervix and sewing it over the latter may be feasible. If it be not possible to do this thoroughly, Werder's procedure is advisable in order to prevent contamination of the peritoneum. After scraping and cleansing the cervix as thoroughly as possible the abdominal incision is made and all the steps carried out as described above as far as the incision of the vagina. The bladder and rectum are dissected downward from the vagina for a considerable distance, and the lateral vaginal attachments loosened. The uterus and vagina are then pushed downwards, an assistant pulling the cervix down by a suture previously inserted. The raw edges of the peritoneum are then closed, the anterior surface of the rectum being approximated to the bladder, and the abdomen is closed. The patient is then

placed in the lithotomy position and the uterus is removed with as much of the vaginal wall as is desired.

Wertheim's plan is also satisfactory. When the vagina is sufficiently freed from the bladder and rectum, an assistant dries it thoroughly with gauze inserted through the vulva. Two-angled forceps are then applied to the vagina as far below the cervix as desirable, and the vaginal wall is divided below them.

Removal of Uterus, Adnexa, and Lymphatics.—This procedure was first suggested by Ries in 1895, and has been adopted by Wertheim and other operators. The Trendelenburg posture is employed. The ovarian vessels are exposed and ligated at the outer part of the infundibulopelvic ligament below the level at which the superior ureteric artery passes from it to the ureter (where the ovarian vessels cross the ureter just above the brim), in order to diminish the risk of necrosis of the ureter.

The round ligaments are tied near the abdominal wall, and dissected free as far as the uterus. The vagina and uterus are separated from bladder and rectum. The broad ligaments are then opened, and the ureters exposed as far as their insertion into the bladder. The uterine artery is ligated on each side as far from the uterus as possible. With a blunt dissector and forceps the cellular tissue, fat, and lymphatic glands are removed from the iliac vessels downward toward the uterus and upper part of the vagina. The latter structures are then removed by one of the methods already described. Finally the openings in the peritoneum are closed. This procedure, essentially that of Ries, is more thorough than that of Wertheim, who removes the uterus before dissecting out the glands. The latter method is one which increases the risk of transplantation of cancer-cells, owing to the division of the parametric tissues near the uterus.

This extensive operation is tedious and requires considerable time, especially in the hands of a beginner. Great care must be taken not to injure any large iliac vein. There may be troublesome venous oozing in the parametric and paravaginal regions. Sampson recommends the following procedure:

The vagina and vulva are cleansed. Catheters are passed into the ureters in order that the latter may be easily recognized during the operation, especially when the uterovaginal and vesicovaginal plexuses of veins require to be secured. A rubber tube is passed into the rectum and left in position during the operation.

The abdomen is opened in the Trendelenburg position, Poter's method (see p. 229) of protecting the general peritoneal cavity being employed. The peritoneum of one infundibulopelvic ligament is divided parallel to the edge, and the ovarian vessels ligated and divided. Beginning at the division of the common iliac artery, a downward dissection is made, removing the fat and lymphatic structures, including the lymph-nodes along the iliac vessels, a blunt dissector or a piece of gauze on a clamp being used. The uterine artery is exposed and ligated at its origin. If there is difficulty in finding this vessel, the obliterated hypogastric should be found and traced back, care being taken not to injure the superior vesical artery.

The other side of the pelvis is similarly treated. The bladder and uterus, with all the tissues from pelvic wall to pelvic wall, are thus made free. The uterus is then drawn up, making the uterosacral ligaments tense; the latter are then divided. The vagina is next separated from the rectum, care being taken to give the cervix and vagina a wide margin.

The bladder is then dissected from the cervix and vagina down to the entrance of the ureters. If the bladder is invaded by the cancer, it should be opened above the affected part, a finger being passed into it, to determine the area involved; the latter is then excised.

The ureters should be dissected free near the bladder, and the veins in the neighborhood tied. The periureteral arterial plexus and the ureteral sheath should be injured as little as possible to reduce to a minimum the risk of ureteral necrosis. If the carcinoma has extended to or beyond the ureters, or if they are compressed, they should be cut off just within the parametrium and also at their entrance into the bladder.

If the ureters are free, it is best not to resect them, but to proceed as follows: Beginning at the entrance of the ureter into the parametrium, an incision is made through the ureteral sheath in its entire length and the ureter shelled out carefully. The latter is then gently drawn to one side.

The cervix and upper part of the vagina are then freed all around. The vagina is next compressed between two clamps at the level selected for its division, and divided between these with a cautery.

If the ureters have been resected, they must next be implanted in the bladder, which must be sufficiently freed from attached structures to allow the ureters to reach it without tension. The latter, with their peritoneal flaps, are drawn downward.

Openings in the bladder-wall may be made in various ways. A long pair of forceps may be introduced through the urethra and pressed against the bladder-wall at the point chosen for incision, as near the original ureteric openings as possible, but at a point which has a good blood-supply and which may be reached by the ureters without tension on the latter. An oblique incision 1 cm. long should be made in the bladder-wall, and the forceps pushed through. The end of the ureter is split from 3 to 5 mm., and after freeing it from its sheath for 1.5 to 2 cm., it is grasped by the forceps and drawn into the bladder-wall. The latter is then sutured to the ureteral wall with two or three fine silk mattress sutures, the latter including only the muscular coats of each structure.

The ureter may be drawn into the bladder in another manner. The latter is grasped with two thumb forceps and incised, the split ureter being drawn into the opening by a suture attached to two needles, which is first passed through the ureteral wall, then into the bladder opening, and out through the bladder-wall, 1 to 1.8 cm. outside the incision.

The ureteral sheath and peritoneal flap are next sutured to the bladder-wall. Care must be taken to avoid compression of the ureter by the suture, and to leave it so that it will not be kinked. The vesico-uterine peritoneal fold should next be sutured to the anterior vaginal wall, and the recto-uterine fold to the posterior wall. All raw areas are covered with peritoneum as much as possible. A small gauze drain is placed in each side of the pelvis and carried into the vagina.

With regard to the postoperative progress of these cases, Sampson points out the great frequency of cystitis. He advises catheterization every three hours with a double catheter, salt-solution irrigation being carried out each time. If a severe cystitis develops, he advises immediate establishment of a vesicovaginal fistula. The latter may be closed at a later period.

Extra- or Retroperitoneal Operation of Amann and Mackenrodt.—A horseshoe incision is made above the symphysis, reaching to the peritoneum. The latter is freed from the tongue-shaped abdominal wall flap and opened transversely above the bladder. The uterus and adnexa are quickly drawn through the opening, the ovarian vessels ligated and cut on each side. Then the anterior parietal peritoneum is stitched to the posterior pelvic wall. This procedure is adopted so as to shut off the general peritoneal cavity in order to reduce the risks. Then the uterus, vagina, glands, etc., are extensively removed. At the end of the operation an extensive raw connective-tissue area exists, which is drained abdominally and vaginally. This procedure cannot be recommended. It is far more risky than the Ries operation. The means used to shut off the general peritoneal cavity are unnecessary, for the same end may be well obtained by the use of sterile gauze pads. The abdominal wall is much weakened by the large incision and the after-drainage.

COMPLICATIONS OF ABDOMINAL HYSTERECTOMY.

Hemorrhage may take place at various stages of the above-described operations. In most instances it is slight and easily controlled; sometimes it may be very troublesome or serious. In dissecting out the uterine vessels a vein or artery may be torn, and the blood may pour out so rapidly as to obscure the field and interfere with the operation. It is advisable in such a case to check the bleeding with forceps until the uterine vessels may be ligated. In dissecting out the lower end of the ureter and in freeing the vagina from bladder, rectum, and paravaginal tissues, there may be troublesome oozing. Rarely an iliac vein may be injured, necessitating ligation. This is a serious complication, as the corresponding lower limbs may be endangered. The ureter may be tied, cut, or torn. If the mistake of tying it be discovered during an operation, the ligature should be removed and the ureter carefully examined. If it has been caught with other tissues, it is not likely to have been injured. If it has been secured alone, its wall may have been cut. In the latter condition it is best to divide the ureter completely and to make a lateral anastomosis. This procedure should be carried out also if it has been cut or torn. Sometimes, in the course of operation, it is found that the lower part of the ureter is invaded by the carcinoma. If this is found out soon after the abdomen is opened, the operation should be discontinued. If it is discovered in the late stages, either the hysterectomy may be completed, leaving the cancerous ureter behind, or the latter may be removed, the healthy part being transplanted into the bladder.

The separation of the ureters from their sheaths, as carried out in the Ries-Wertheim operation, may be followed by necrosis, owing to injury to the peri-ureteral vascular supply. This may be succeeded by rupture and extravasation of urine, which may be fatal; or a fistula may be established through the abdominal or vaginal incision. The ureter may also become kinked or constricted by cicatricial tissue, injured by the presence of the gauze, or involved in infectious processes succeeding the operation.

Sampson's procedure of resecting the ureters may be followed by separation of the latter from the bladder by kinking or stricture; if cystitis occurs, the risk of an ascending infection is very much increased. The bladder may be injured in various ways: a large portion of it may be exposed in removing the uterus, vagina, and parametric tissue; its nervous and blood-supply may be diminished. Cystitis is, therefore, easily produced after operation, if organisms are in any manner introduced, owing to diminished resistance of the viscus. In carrying out the extensive operation the exposed bladder-wall should be covered as much as possible with peritoneum.

The bladder may be torn or cut and, unless repair be carried out at once, a fistula will result. Sometimes the carcinoma may be unexpectedly found to involve the viscus. In such a case it may be advisable to abandon the operation, or, if the affected area be small, to excise a portion of the wall.

RESULTS OF HYSTERECTOMY.

Immediate.—The mortality associated with vaginal hysterectomy for carcinoma of the uterus has been gradually reduced in recent years, but there are considerable differences in the statistics presented by various operators. Sampson reports, in Johns Hopkins Hospital, 63 vaginal hysterectomies with 5 deaths. Olshausen's mortality is about 6 per cent.; the author's is about 1.5 per cent.

Ricard, in 1899, placed the death-rate in the hands of French operators at 16 to 19.68 per cent.

French operators found it to be 8.9 per cent. Bigeard, from a study of French and other statistics, stated it to vary from 17 to 20 per cent. Byrne has recently collected reports from 38 European and American operators, the average primary mortality being 14.6 per cent.; in Germany it is stated by Taussig to be about 8 per cent. Such a death-rate is higher than would seem necessary with present-day technic.

The chief cause of death is infection. Sometimes it is due to ligation of one or both ureters, though in some cases this error has not been fatal, but has been followed by the establishment of a ureterovaginal fistula. Sometimes the bladder is infected, leading to fatal involvement of the kidneys. Hemorrhage is rarely a cause, and should always be avoidable. Acute prolapse of the intestine may take place through the opening in the fornix if it be large, especially if the patient vomits greatly after operation; this may be followed by strangulation, peritonitis, and death.

With regard to abdominal hysterectomy for carcinoma, a smaller number of statistics are at hand, as the operation has been much less frequently performed. The mortality is generally considered to be higher than in the case of the vaginal procedure. Sampson reports 67 abdominal hysterectomies at Johns Hopkins Hospital, with 16 deaths, and 26 combined abdominal and vaginal operations, with 5 deaths.

The extensive abdominal operations of Ries, Wertheim, and Sampson have been performed in a comparatively small number of cases. The mortality has been reported as about 20 per cent. Taussig has collected reports of 255 Wertheim operations, with a mortality of 17 per cent.

Remote.—The remote results of hysterectomy, not including the extensive Wertheim and Ries operations, demonstrate that in a very large percentage of cases recurrence of the carcinoma takes place, causing death. R. Williams gives the following table of recurrences prepared from Hache's statistics of 144 vaginal hysterectomies:

TIME.	PER CENT.
Under 3 months.....	19.4
3 to 6 ".....	18.0
6 to 9 ".....	10.5
9 to 12 ".....	7.6
12 to 18 ".....	12.5
18 to 24 ".....	9.8
2 to 3 years.....	14.6
Over 3 years.....	7.6

These figures show that over 55 per cent. occurred during the first year, and nearly 20 per cent. within the first three months.

Very late recurrences, *e. g.*, to fifteen years, have rarely been reported. Leopold has given an analysis of 194 cases. Of these, 10 died after operation; 11 died of other diseases; 50 had died of recurrent carcinoma at the time of publication of the statistics, or 37.5 per cent.

The time after operation in the 50 cases in which death occurred was as follows:

In 3 at 3, 4, and 5 months respectively.
 " 3 at 6 months.
 " 2 at 7 "
 " 2 at 8 "
 " 4 at 9 "
 " 3 at 10 "
 " 21 from 12 to 24 months.
 " 4 during the third year.
 " 5 during the fourth "
 " 1 during the fifth "
 " 2 during the sixth "

The average duration of life was, therefore, in these cases 19.7 months.

Of the 90 patients living, 75 had remained free of recurrence. Of the whole 140 cases, therefore, which survived operation and did not die of other disease, the following table gives their history:

Died of recurrent disease.....	50 or 35.7 per cent.	} Recurrence in 47.1 per cent.
Living with recurrence.....	16 or 11.4 " "	
Living and healthy.....	74 or 52.9 " "	
	140 or 100 " "	

Excluding all cases operated on within two years, 123 may be considered. Of these, 9 died from operation, 9 from other diseases, and 1 could not be traced. Of the remaining 104 --

46 died of a recurrence.....	or 44.2 per cent.
58 lived.....	or 55.8 " "

The length of life of the patients after operation is as follows:

Of 104 operated on, there lived longer than 2 years	58 or 55.7 per cent.
" 84 " " " " " 3 " "	45 or 53.5 " "
" 61 " " " " " 4 " "	38 or 62.3 " "
" 47 " " " " " 5 " "	29 or 61.7 " "
" 33 " " " " " 6 " "	22 or 66.6 " "
" 21 " " " " " 7 " "	16 or 76.1 " "
" 8 " " " " " 8 " "	6 or 75.0 " "

Variations in the length of time between operation and return was noted in seven cases as follows:

In 1 over 8 years.	In 1 about 5.9 years.
" 1 about 7 "	" 1 " 4.4 "
" 1 " 6.5 "	" 1 " 4.2 "
	In 1 about 2.6 years.

Byrne has reported on cases operated according to his method as follows:

In 40 cases of cancer of the portio vaginalis there was exemption from 2 to 22 years, an average of 9 years for each. In 50 cases in which the whole cervix was affected, 10 were well after 2 years, 11 after 3 years, 6 after 4 years, 6 after 7 years, 2 over 11 years, 1 over 13 years, and 1 over 17 years.

Olshausen has recently reported a large series of vaginal hysterectomies and states that 74 per cent. of the cases operated on were free from recurrence at the end of two years, and 38.8 per cent. at the end of five years. Wertheim has recently made a report regarding a series of cases in which his extensive method was employed.

Of his first series of 30 cases, all operated on more than two and one-half years before the report, 77 per cent. were free from return of cancer. Of his second series of 30 cases, all were over one year old, 75 per cent. being free.

In 1901 Schuchardt reported 58 cases in which his operation was performed, with a mortality of 12 per cent. Of this number, 25 were operated upon between 1894 and 1896, and there was a return of the cancer in 52 per cent. of these. During these three years he operated on 61 per cent. of all his cases, and he then claims as absolute cures a percentage of 24.5.

In 1899 Stadel reported 30 cases operated on by this method, with a mortality of 13.3 per cent. Of the 26 survivors, only 3 were free from recurrence at the time of the report, and of these, the longest interval after operation was one year.

There is a higher percentage of permanent cures after extirpation of the uterus for disease of the body than after removal for cervical cancer. Wilson has studied a number of reports by different operators, and states that, on the average, about two-thirds of the cases have no recurrence.

The great majority of recurrences are found in the parametrium adjacent to the incision. Of 58 recurrences, Winter found that 54 were in this region. This observer reports that in 44 autopsies recurrence was found in lymphatic glands only in two cases.

The earlier the disease and the more limited it is to the uterus, the less likely is recurrence to take place.

Leopold found recurrence in 23.7 per cent. of 59 cases considered by him to be early at the time of operation, and in 66.1 per cent. of 68 advanced cases.

It is believed by many that in some cases recurrence is due to the detachment of small portions of carcinoma by the instruments during the operation. This is probably rarely the cause. In most cases the disease has been simply left in the lymphatics of the parametrium, where it was not recognizable on palpation.

Metastatic recurrences are rare: Winter reports only 9 after 202 operations.

In cases of recurrence of cancer many years after operation it is difficult to know whether the disease develops from cells produced by the original cancer and which have remained latent in the system or whether it has an independent origin.

In order that the most accurate information should be obtained concerning the results of treatment, some common system of study and classification should be adopted.

Winter has proposed the following scheme. In making an estimate as to final results—

- (a) A definite period must be fixed and all operation cases included.
- (b) The final results must be subdivided as follows:
 1. Cases in which death was attributable to the operation.
 2. Those in which death was due to some other disease.
 3. The forgotten cases.

Palliative and incomplete measures if begun with a view to performing total extirpation should be included in statistics.

(c) Five years should be regarded as the time which should elapse before a final cure may be pronounced.

(d) Examination to decide as to presence or absence must be made in the hospital where the operation was performed. Patients' letters should rarely be used.

(e) Estimates as regards recurrence of particular forms of cancer must be made with caution.

(f) The division of recurrences into local and spreading forms is useless.

In many cases, instead of allowing the disease to follow its own course, it is advisable to carry out certain measures of a palliative nature, in order to keep the patient in as comfortable a condition as possible.

For profuse hemorrhage, plugging of the vagina for two or three days with antiseptic gauze is the best remedy. To keep down the offensive discharge, various douches may be used, *e. g.*, solution of formalin, potassium permanganate, corrosive sublimate, iodid of mercury, etc. After the douche a mixture of equal parts of sterile glycerin and olive-oil should be injected into the vagina, and the vulva lubricated with the same mixture.

To destroy superficial portions of the growth the following means may be used:

Curetage, with application of the cautery or caustic. The carcinomatous tissue is scraped out with a spoon curet, care being taken not to perforate the uterine wall. The raw oozing surface is then cauterized. A pledget of cotton soaked in pure formalin, excess of fluid being squeezed out, is inserted in the raw cavity, and a piece of thin gutta-percha tissue placed beneath the cotton. The vagina is then packed with antiseptic gauze. After three days the gauze and cotton are removed and a douche of formalin lotion (25 min. to 1 pint) is used twice daily.

Various caustic applications have been employed, *e. g.*, zinc chlorid. The author has discarded all of them in favor of the method just described.

Amputation of as much of the cervix as possible may be carried out by the method already described on p. 468.

The *écraseur* or galvanocautic wire has also been used for this purpose. The patient is placed in the lithotomy position, the vagina opened with specula, the cervix held with a volsella, and the chain or wire then placed around it. The amputation should proceed very slowly. If there is bleeding afterward, the points should be touched with the Paquelin cautery, and an antiseptic gauze tampon placed in the vagina for five or six days.

The author prefers the cautery for removing the cervix or even larger portions of the uterus in such cases. By slow procedure igniextirpation may be safely carried out, "dull heat" being employed. Hemorrhage is not usually severe, and may generally be checked by a firm tampon, though sometimes it is necessary to apply pressure-forceps for a few days. John Byrne recommends removal of the whole uterus except a thin shell at the fundus by the use of an electric knife, the raw surface being thoroughly roasted.

Ligation of various vessels supplying the uterus, *e. g.*, uterine, ovarian, internal iliac, has been tried by several operators, but can scarcely be considered justifiable, since no appreciable modification of the course of the dis-

ease is brought about. The ligation must be carried out by the abdominal route. In a few cases lessened hemorrhage or discharge has been noted for a time.

x-ray applications to the cancerous cervix have been made through a vaginal tube, with varying results. In no case has the disease been materially modified. Occasionally there has been some shrinkage in the superficial portion, but the deeper progress of the carcinoma has not been checked or modified.

Those who advise the *x*-ray treatment in early cases in which there is a chance of removing the disease by extirpation deserve only the most severe condemnation.

General Measures.—Pain must be relieved with morphin; if trional be used with this drug, small quantities will often suffice. Atropin may be combined with the morphin if there be vomiting. Heroin or codein is also most satisfactory.

The digestion should be carefully looked after, and the bowels kept regular. A diet containing vegetables and fruit, *e. g.*, prunes, roast apples, etc., is valuable; laxatives may, however, be required. Usually a daily enema containing an ounce of glycerin acts satisfactorily. The patient should sleep in a well-ventilated room, should be placed in cheerful surroundings, and be free from worries and cares.

In bed, a piece of thin waterproof sheeting tied around the body keeps down the bad odor, and in the day a petticoat of similar material should be worn. Sexual intercourse should be abandoned. The skin around the vulva is to be protected by vaselin, olive-oil and glycerin, or olive-oil and lime-water.

CARCINOMA CORPORIS UTERI.

Cancer of the body of the uterus occurs in less than 2 per cent. of all cases. It is relatively more frequent in nulliparæ than cancer of the cervix, and tends to occur rather later in life than the latter, and has, on the average, a slower rate of growth.

The disease is usually primary. Very rarely it is secondary to carcinoma in some distant organ, *e. g.*, mamma, ovary. Direct extension to the uterus may take place in ovarian or intestinal carcinoma, when there is direct contact.

Varieties.—*Primary.*—Adenocarcinoma is most frequently found. It may develop in the endometrium at any point. Early, it usually appears as a circumscribed, shaggy growth, formed of many, delicate processes. It may spread over a wide extent of the mucosa. In some cases several independent growths are found. Sometimes polypoid projections may form. Usually the masses are soft in consistence, but in some cases are very firm. The uterine cavity may be considerably increased in size by the development of the disease.

While it projects from the surface, it invades the uterine wall at the same time in an irregular manner. As it reaches the peritoneal layer it usually appears as a number of smooth, small, yellowish-white swellings.

Great variations are found in the extent to which each of these processes is developed. Cullen thinks that when the papillary arrangement is most marked, the growth has commenced in the surface epithelium; and that,

when the gland-like arrangement is more in evidence, the process has started first in the glands.

As the cancer develops the oldest portions necrose and break down. In this way the projections may entirely disappear, leaving an irregular cavity which produces a foul discharge. Occasionally there may be marked advance of the disease before the musculature is much involved.

Accumulation of the discharge forming pyometra is rare. Perforation of the peritoneal surface rarely occurs, as adhesions tend to form; infective general peritonitis may result. Communication with an adherent piece of intestine may sometimes develop. In some cases multiple peritoneal growths may appear, involving omentum, intestine, parietes, etc. Metastases may occur in the lungs, pleura, liver, and other parts. On microscopic examination the characteristic features are found to be as follows: There is prolifera-

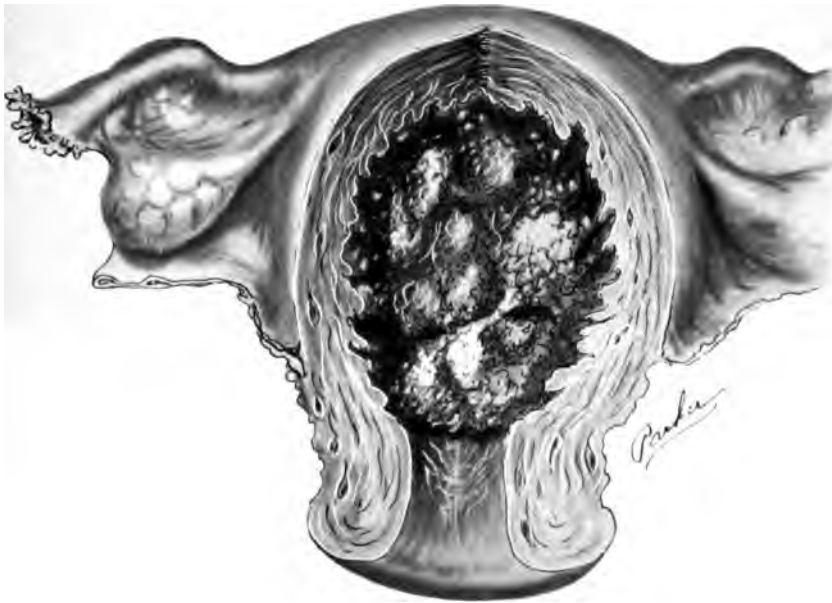


Fig. 329.—Excavation of body of uterus by carcinoma.

tion of the surface epithelium, forming processes into which vascular connective tissue penetrates, forming a core. The epithelial cells vary considerably in size and stain deeply. As a rule, they are found in several layers, though occasionally only one may be found.

At the outer portions of the processes many gland-like spaces are formed. The glands in the affected portion of the mucosa increase in size, their epithelium forming more than one layer. New glands also are produced. In some cases there may be a tendency toward the production of spaces lined by a single layer of cells, and to this form the term "malignant adenoma" has been applied.

Occasionally very few glands are seen, the epithelial cells being found in large masses in which connective-tissue strands run.

Cullen points out that occasionally longitudinal sections of glands lie side by side, not separated by stroma, and resembling, under low power, bands of syncytium.

In some glands where there has been a marked multiplication of epithelium the cells may be so closely pressed together as to resemble a squamous-cell growth. The appearance must not be interpreted as a mixture of squamous-cell carcinoma and adenocarcinoma, for the transformation of the cells is probably accidental and mechanic.

Hitschmann and others, however, hold that metaplasia from cylindric to squamous epithelium may take place, both as regards the surface and glandular layers. The masses of squamous epithelium thus derived may equal or surpass in bulk the glandular portions of the growth, and may undergo horny change and calcification.

Emmanuel believes that the squamous cells arise only from the proliferating cancer-cells.

Hengge states that a transition from columnar to stratified epithelium may take place apart from malignancy, due to various irritants—mechanic, chemic, or bacterial.

Rarely while the disease is in the corpus uteri, an independent nodule may develop in the vagina. This may be due to implantation or to transmission through lymphatics by a backward flow of the lymph.

Lymphatic extension of the disease is not often found—at least, not until the advanced stages, when large lymph-channels are opened. Lubarsh holds that the large epithelial cells can rarely enter the ordinary small lymphatics. The glands which receive the lymphatics of the uterine body and which are, therefore, likely to be involved are the lumbar glands, which lie in front of and on each side of the aorta and vena cava opposite the lower end of the kidney. When the disease involves the cornu of the uterus, it may be carried along the round ligament to the corresponding inguinal glands. Various distant glands may sometimes be involved, *e. g.*, bronchial, neck, etc. The tube and ovary are very rarely involved, and usually in advanced cases. The former is most likely to be affected by extension from the cornua. Secondary ovarian growths are sometimes found.

Adenocarcinoma of the uterine body may be associated with fibromyomata. When the latter are large, the presence of the former is likely not to be suspected. Indeed, usually examination of scrapings is necessary to establish the diagnosis of malignancy. But curetage must be thoroughly carried out

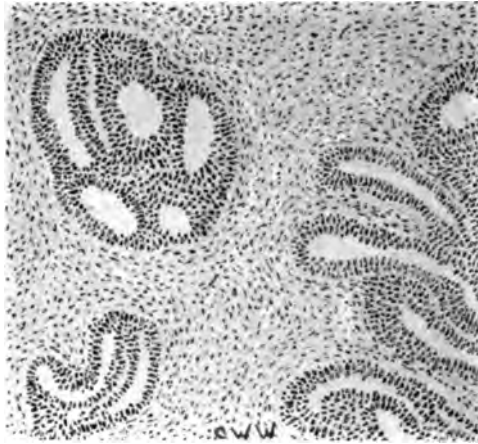


Fig. 330. —Adenocarcinoma of body of uterus
($\times 55$).

in order that the cancerous areas be not missed. Very rarely adenocarcinoma and sarcoma may be found in the same uterus. Sarcoma, carcinoma, and myoma have also been found together. Squamous-cell carcinoma of the uterine body is very rare.

Symptoms.—Several variations are found in the symptomatology. In a considerable percentage of cases there may be an extensive development of the disease before the patient's attention is directed to it. Often in the early stages there is an increased escape of secretion from the uterus, which may be thin and watery. This becomes blood-stained at a later period. The discharge gradually develops a foul smell, and may be irritating. If the patient has not reached the menopause, menorrhagia and metrorrhagia may be noted; if she has passed the menopause, irregular discharges of blood occur. In some cases the loss of blood takes place at a much later period than in others; as a rule, it is a late manifestation.

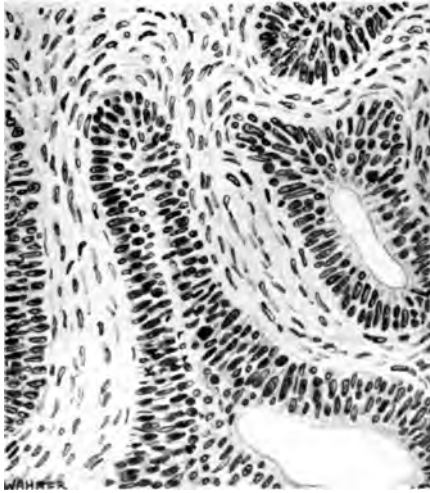


Fig. 331.—Adenocarcinoma of uterus (body)
($\times 265\frac{1}{2}$).

Pain is a very variable symptom. In some cases there is only a feeling of aching in the pelvis. Sometimes there is pain only at intervals, due to the accumulation of discharge in the uterus. Ordinarily, severe constant pain develops only in the latest stages, when there is an extension of the disease toward the pelvic wall; usually there is, as well, a radiation of the pains to the thighs and elsewhere. General weakness gradually develops, and in the late stages there is the characteristic cachexia.

Diagnosis.—In the early period of the disease no changes can be detected by bimanual examination. Later, the body is enlarged, varying in different cases. In the advanced stages it is usually fixed and ir-

regular, extensions outside it being palpable.

The parametrium is invaded at a relatively later period than in carcinoma of the cervix.

A positive diagnosis can be established only by examining scrapings microscopically.

Differential Diagnosis.—All conditions which may cause uterine hemorrhages, foul discharge, etc., may more or less simulate the disease.

Endometritis.—Inflammatory changes in the mucosa, especially when associated with the formation of large blood-spaces, may lead to irregular hemorrhages. In cases of hypertrophic enlargement, polypoid masses may be formed. In senile cases foul discharge may be due to an infective process and there may be, as well, losses of blood. The examination of scrapings of the uterine mucosa reveals the true nature of the changes, which are different from those caused by adenocarcinoma.

Incomplete Emptying of the Uterus after Labor.—When portions of the ovum are left in the uterus after an abortion or labor, especially chorionic tissue, irregular hemorrhages usually occur. When saprophytes invade the uterine cavity, the discharge may have a very foul odor. The woman may become rapidly weakened, and develop a cachectic appearance. The microscopic examination of scrapings from the uterine cavity serves to distinguish the condition from adenocarcinoma.

Portions of syncytium may simulate masses of cancer-cells. Decidual cells may also be mistaken for them. In all such cases the possibility of the development of chorioepithelioma malignum must be kept in mind.

Fibromyoma.—The hemorrhages caused by myomata may sometimes lead to a suspicion of malignancy, especially when the tumors are small and submucous. In cases in which ulceration or necrosis in the growth causes a foul discharge, the simulation may be more marked. Scrapings of the mucosa, while showing the changes associated with fibroids (p. 516), present none of those which are characteristic of adenocarcinoma. Sarcoma and tuberculosis of the endometrium may also be mistaken for carcinoma, and can be distinguished only by the examination of scrapings.

Squamous-cell Carcinoma (Epidermoidal Cancer).—This variety of carcinoma is so very rare in the uterine body as to be almost unknown. Several cases have been reported, which must be regarded as doubtful. Attention has already been drawn to the simulation of this condition by certain arrangements of the epithelial cells in adenocarcinoma. The disease has probably been found after the menopause. The histologic features are similar to those described in connection with squamous-cell cancer of the cervix.

Endothelial cancer of the uterine body has been described by Pick.

Treatment.—In every case of carcinoma of the uterine body in which extension to neighboring tissues cannot be distinguished, removal of the uterus, tubes, ovaries, and round ligaments by the abdominal route should be performed. The lumbar and iliac glands may be at the same time carefully examined. The latter are rarely involved, probably only in those cases in which the upper part of the cervix is involved in the carcinoma. In such a case the extensive operation of Ries should be carried out. Vaginal hysterectomy is not to be performed in these cases because it does not permit a thorough examination of the pelvis and abdomen, so that the justifiability of removal of the uterus may in the first place be decided. There is always uncertainty as to the amount of destruction of the uterine wall, and the risk of tearing the latter is very much greater than when the abdominal route is selected. The vaginal operation does not permit the extirpation of glands.

SARCOMA UTERI.

Primary sarcoma of the uterus is rare. R. Williams reports 2 in 2649 consecutive cases of new-growths of that organ; Gurlt, 8 in 4115 cases; Gressner, 18 in 9133 cases; According to R. Williams, the disease is as common in the cervix as in the body of the uterus. The organ may be secondarily affected with sarcoma by extension from neighboring structures, *e. g.*, the ovaries.

Etiology.—The causation of sarcoma is unknown. The disease may develop at any time from early infancy to old age. Hollander has reported a

case in an infant of seven months. Of 73 cases collected by Gusscrow, 4 occurred in females under twenty-nine years of age; 15 between the ages of thirty and forty; 28 between forty and fifty; 18 between fifty and sixty; three in women over sixty. One case of sarcoma uteri above the age of seventy has

been reported. The disease has no evident relationship to child-bearing, trauma, or inflammation.

Classification.—The disease may be considered in relation to the various parts of the uterus in which it may develop or according to the microscopic characters of the neoplasm.

1. *Sarcoma of the Corpus Uteri.*—(a) *Commencing in the Endometrium.*—This variety is mostly found in adults, rarely in early life. The new-growth may develop in the interglandular connective tissue or in that surrounding blood-vessels and lymphatics. It usually spreads as a diffuse infiltration of the mucosa, often forming irregular projections, as nodes or polyps; sometimes the latter may project downward as elongated masses, even reaching the vagina. The uterine body may become much enlarged, and extension along the Fallopian tubes or directly through the uterine wall may occur. It tends to weaken the latter and so to favor inversion. The cervical canal is often patulous. Sarcomata are usually soft and brain-like, vascular, and fri-



Fig. 332.—Large sarcoma of the cervix projecting through the vulva.

able. Necrosis and saprophytic invasion may easily occur. Hematometra and pyometra may result. Rarely, the mucosal sarcoma may remain localized for a considerable time, tending to form a polypoid projection.

All varieties of sarcomatous cells may be formed in these growths, but the round-cells are most common. Myxomatous changes and edema may be found and may lead to the formation of grape-like masses. Fibrous changes may take place. Pigment is sometimes found in the cells. Giant-cells may occur.

Glands may be found in some specimens, but usually they are destroyed early in the disease. Small cysts may occasionally be noticed. Rarely fatty or cartilaginous tissue may be associated with sarcoma.

When the new-growth is scraped away, it tends to grow again rapidly. It may become disseminated in the vagina and other pelvic tissues or in distant organs, *e. g.*, the lungs.

(b) *Commencing in the Substance of the Wall of the Corpus Uteri.*—Sarcomata

which develop in this situation are chiefly found in adults, rarely in early life. They usually occur as circumscribed masses, though they may sometimes spread diffusely. According to many pathologists, such growths arise generally, if not always, in fibromyomata. They may undoubtedly occasionally develop from the connective tissue of the uterine wall. They are frequently polypoid, extending into the uterine cavity or outward subperitoneally. They tend to become infected, to slough, or to become gangrenous. Myxomatous degeneration and edema are common. Telangiectatic, lymphangiectatic, and cystic alterations are occasionally found. The latter are rare and are mostly due to localized degeneration and softening in the substance of the tumor. Yet in some cases unilocular or multilocular cysts may be found. These are probably derived from inclusions of the Wolffian body, as well as from Müllerian glands; they may also be formed from blood-vessels or lymphatics. Cystic sarcomata are usually subperitoneal pedunculated growths. They may reach a very large size and are very apt to be adherent.

2. *Sarcoma of the Cervix.*—The cervix may be the seat of sarcoma at various periods of life. The majority of uterine sarcomata occurring in infancy and early life are cervical. According to Roger Williams, these are mostly of



Fig. 333.—Polypoidal fibrosarcoma growing from the cervix and distending the vagina.

blastogenic origin. He remarks on the frequency with which heterotopic elements are found in them. The growth may be polypoid and multiple, especially when occurring in children. In some cases the tumor is described as botryoid, consisting of masses resembling a bunch of grapes or a hydatidiform mole. The small rounded projections are soft and gelatiniform in appearance, and are caused by edema or myxomatous degeneration in the tumor. Pseudocystic and true cystic changes may be found in them. These growths are very malignant, and recur quickly after removal. Single large polypoid tumors are also found. In some cases sarcoma may develop in the substance of the cervical wall, infiltrating the surrounding tissues.

Microscopic Appearances in Sarcoma.—Cells of different shapes are usually found in sarcomata. It is rare to find a tumor composed entirely of one variety. Usually one is predominant and gives the name to the growth. The round-cell variety consists of small or large cells with a large nucleus and a small quantity of surrounding protoplasm. Chromatin is found in varying amounts, and karyokinetic figures are common. Oat-shaped cells are occasionally found. Spindle-shaped cells are very common. Giant-cells are infrequent; they are polynuclear and are rich in chromatin. They may measure 80 or 90 μ in diameter. Melanotic growths, *i. e.*, those in which richly pigmented cells are present, are rare.

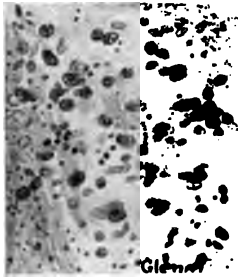


Fig. 334.—Round-cell sarcoma of body of uterus ($\times 205$).

The fibrillar framework of sarcomata varies greatly in appearance. Sometimes it is scarcely noticeable; in other cases it is so well developed as to give the name *fibrosarcoma* to the growth. Usually, the connective tissue is uniformly diffused among the sarcoma-cells.

Sometimes it surrounds groups of the latter, causing a resemblance to cancer-nests—the so-called *alveolar sarcoma*.

Many newly formed blood-vessels are found in sarcomata; in some they are so abundant as to give to the growth the name *angiosarcoma*. The blood-spaces are in intimate relation with the sarcoma-cells. All forms of degeneration may be found in these tumors.

Carcinoma of the uterus is very rare in conjunction with sarcoma.

Symptoms.—These are similar to those caused by cancer, *viz.*, menorrhagia, metrorrhagia, discharge, pain.

The loss of blood is most marked when the growth breaks down. The discharge is sometimes thin and watery, or like meat-juice, but usually becomes thick, containing debris having a foul odor. The pain may be very intense, especially in the cases where the growth develops in the substance of the uterine wall, or where the uterine cavity becomes rapidly distended by mucosal growths or by accumulated blood. There is also usually much suffering when there are peritonitis and adhesions, and in the infiltrating conditions of late stages of the disease.

In some cases there is little or no pain, especially in those soft mucosal tumors which tend to grow as polyps into the vagina. The patient gradually loses strength and develops a cachectic appearance.

Physical Signs.—On bimanual examination the uterus is found to be

enlarged. Soft, pliable, polypoid masses may sometimes be felt projecting through the cervix. If the cervix be dilated sufficiently to admit the finger, the irregularities in the cavity may be distinguished. Bleeding is usually easily caused. Fixation of the uterus may be made out, or extension along the tubes, in the broad ligaments, or elsewhere. The sound is to be used very cautiously.

Differential Diagnosis.—The diagnosis is not always easy. The following conditions may simulate sarcoma, viz., hemorrhagic endometritis, fibroids, cancer, adenoma, tuberculosis, retained portions of placenta or membranes. In the great majority of cases the microscopic examination of scrapings is sufficient to establish a diagnosis. Sometimes, however, it is difficult or impossible. The connective-tissue cells of the uterine mucosa when altered by inflammation may resemble many of the cells found in sarcomata. Sometimes, especially in early stages of the disease, a scraping from the uterus may fail to reveal sarcoma, though it may be found when the uterus is extirpated. A microscopic study of several portions should always be made, and the results of the examination should be considered along with the physical findings in the case before a final opinion is given.

When sarcoma develops in a fibroid, its presence is not usually suspected in the early stages. Indeed, it is frequently never recognized until far advanced. Rapid growth, a softer consistence, pain, ascites, metastatic growths, cachexia, are the chief changes noted as the result of sarcomatous growth in fibroids, though several of them may be associated with certain fibroids in which no malignancy is present. The microscopic examination of scrapings of the uterine mucosa in sarcomatous fibroids is frequently of no value in establishing a diagnosis, because the endometrium may not have become involved.

Prognosis.—The prognosis is most grave in the rapidly growing forms. In the slow-growing fibrosarcoma the disease may continue for years, the average period being, according to some, three years. It may continue, however, for a longer period.

Treatment.—Total extirpation of the uterus and adnexa offers the only hope of radical cure. The abdominal method should be chosen. When extirpation is impossible, palliative measures similar to those used in uterine cancer should be employed. Great variations are noted as regards the rate of recurrence after curetage.

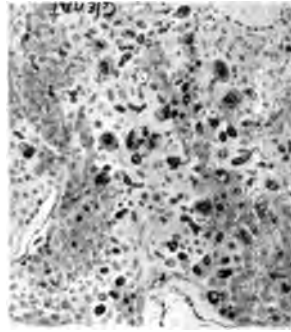


Fig. 335.—Mixed-cell sarcoma of cervix ($\times 205$).

CHORIO-EPITHELIOMA MALIGNUM.

In 1888 Sanger, of Leipzig, described two cases in which, after abortion, soft, spongy tumors developed in the uterus, with metastases in the lungs and other tissues, leading to a fatal issue. He believed the growths to belong to the sarcomatous group, and introduced the term "deciduoma malignum" to describe them.

Since that time quite a number of similar cases have been described, and there has been much difference of opinion as to their pathology. Various other names have been given to the disease, *i. e.*, chorioma, sarcoma deciduocellulare, sarcoma choriocellulare, syncytioma malignum, carcinoma syncytiale, etc.

By some the growths have been regarded as fetal, by others as maternal, and by others as a mixture of both. There have also been differences of views as to whether they are of epiblastic or mesoblastic origin. The term "chorio-epithelioma malignum," introduced by Marchand, may be regarded at the present time as the most satisfactory appellation, for the tumors must be regarded as malignant proliferations of the epiblastic elements of the chorion—viz., syncytium and Langhans' cells, developing primarily in the genital organs and secondarily as metastases in various other tissues. The condition

has been found at all periods of sexual life, mostly between twenty and thirty. McCann has reported a case developing years after the menopause.

It is interesting to note that several cases of primary growth remote from the normal implantation area of the ovum have been recorded. Thus it has been reported in the tube, ovary, vagina (see p. 353). Reference must also be made to the occurrence of growths in the testes of males, in which syncytial structures have been similar to those found in many cases of uterine chorio-epithelioma. Schlagenhauer is believed to have established their identity with fetal epithelium. They also form metastases. These tumors must be regarded as embryomata, or tumors in



Fig. 336. —Syncytioma malignum, showing Langhans' cells and syncytium (from a nodule in vulva $\times 78$).

which the segregation of embryonic material has taken place during pregnancy.

Relation to Pregnancy.—The disease may sometimes begin during pregnancy, though usually it appears within a few days, weeks, or months after labor. MacKenna states that in the cases collected by him the average interval between labor and the earliest symptoms was ten weeks. It has also been stated that rarely one or more years may elapse. It may follow abortion, full-time labor, ectopic pregnancy, and hydatidiform degeneration of the chorion. A considerable proportion of cases has been described in relation to the latter. Multiparity has no influence upon the development of the growth.

Clinical Features.—Hemorrhage is usually the first and most prominent symptom; it is at first irregular, afterward becoming more profuse and frequent. A dirty, watery discharge gradually makes its appearance. Weak-

ness and cachexia supervene. Pain is not a noticeable feature. Other symptoms may be produced by metastatic developments, *i. e.*, in the vagina, lungs, kidneys, intestines, liver, ribs, etc. There is often elevation of temperature and the pulse is rapid. In cases following uterine pregnancy the primary growth is usually in the uterus, rarely in the vagina; Wehle has reported a case of its appearance in the labium. When the disease begins in the uterus, it forms a nodule in the mucosa, which is soon followed by others. They are soft and pliable and recur rapidly after curetage. The uterus is larger and softer than usual on palpation and is somewhat tender. Rarely the growth causes rupture of the uterine wall. Vaginal growths are recognized as soft, bluish nodules, which readily break down. The disease progresses rapidly and is almost always fatal, death usually occurring within six months, whether operative treatment be carried out or not.

Etiology and Pathology.—That these tumors are a development from fetal chorionic structures is now well established. The microscopic appearances vary considerably, according to the distribution and relationships of the constituent cells. Usually there is a mixture of cells, derived both from the syncytium and the Langhans layer of the epiblastic covering of the chorion. In some cases the former predominate; in others, the latter. Recently growths have been described consisting entirely of syncytial elements. The syncytium consists of irregular masses of nucleated protoplasm, often vacuolated, the nuclei being rich in chromatin, somewhat oval, their long axes often being parallel to the border of the masses. Mitoses are not found in them. The cells derived from the Langhans layer are clear and mostly polyhedral, varying in shape and size, and do not possess any intercellular connective tissue. They contain glycogen; the nuclei are round or oval, larger than those of the syncytium, and stain less deeply. Blood-extravasation is found around and among the cell-groups. Degeneration and necrosis are frequently present in the tissues. In another class of cases, in addition to these cellular elements structures have been found exactly resembling early villi, *i. e.*, vacuolated buds or rings of epiblast filled with early mucoid tissue. These have been chiefly noticed in cases of hydatid mole. Growths are carried by the blood-vessels; they resemble the primary nodules. In my description of normal placentation* it has been pointed out that portions of the fetal epithelium are often found in the veins of the uterus, whence they are carried into the general circulation without causing any known disturbance.

Metastatic growths rarely spread by way of the lymph-glands.

Diagnosis.—In the early stages of the disease, before any large swelling, metastases, or cachexia has developed, diagnosis is not easy. Loss of blood from the genital tract in the puerperium may be due to various conditions, *i. e.*, subinvolution, retained portions of fetal tissue, fibroid tumors, etc. Foul discharge may also be caused by infection of blood-clot, fetal remains, tumors, etc. Moreover, sarcoma or carcinoma of the maternal tissues may cause these changes.

In every case the most thorough physical examination of the genitalia must be made, the interior of the uterus being explored by the fingers. Abnormal projections of tissue should be removed and examined microscopically. If marked proliferation of the syncytium and Langhans' cells be found, especially in a nodule, the suspicion of the existence of chorio-epithelioma malignum is

*"Text-book of Obstetrics," W. B. Saunders Co.

very strong. In difficult cases the opinion of one who is an expert in the microscopic study of the uterus and its contents during pregnancy is of the greatest value, for it must be remembered that after abortion, hydatid mole, and full-time labor, scrapings of the uterine mucosa may contain different chorionic elements that have not been expelled at birth, and these might easily be regarded as chorio-epithelioma malignum by inexperienced observers. Moreover, decidual cells may also be found in the scrapings, and these may sometimes be very difficult to distinguish from the chorionic epithelial elements, especially the proliferated Langhans' cells of the malignant growth.

As Pierce states, extreme caution must be used, especially in the case of a young woman. He advises that if the examination of the first scrapings is not conclusive, the patient be kept under observation a short time and cureted again. If malignancy be present, increased proliferation of the cells will be found; if not, a small quantity of the cells or none at all will be detected. After curetage the malignant growth usually rapidly recurs. Thus, Marchand reports a case where five days after thorough curetage the uterus was again filled.

The disease may be difficult to distinguish from carcinoma or sarcoma of the maternal tissues. In the latter growths true syncytium or structures resembling early villi are not found. Giant-cells may, however, sometimes resemble portions of syncytium. Chorio-epithelioma has no stroma, differing from carcinoma; the latter disease is carried by the lymphatics and the metastases develop more slowly than in the case of chorio-epithelioma. Only rarely are the lymphatic glands involved in chorio-epithelioma. Liver metastases are more common in sarcoma and carcinoma. Carcinoma mostly occurs after forty; chorio-epithelioma before thirty.

Treatment.—Only one form of treatment is advisable, viz., total extirpation of the uterus, when the disease begins in this organ, and of the uterus and vagina when it begins in the latter. Owing to the frequency of the disease after hydatid mole, Riesmann advises routine curetage of the uterus ten to fourteen days after expulsion of the mole. If proliferation of the chorionic epithelium be found, he removes the uterus.

As regards the method of extirpation of the uterus, Pierce rightly advises the abdominal route, because the organ may be removed with less disturbance than when the vaginal operation is chosen. He points out that manipulations of the uterus are apt to force fragments of the uterine growth into the veins, thus increasing the risk of metastatic development.

When the abdomen is opened, the first step in the operation should be ligation or clamping of the uterine and ovarian vessels before the uterus is handled.

Eiermann has collected statistics of thirty operated cases, six of which were free from recurrence after two or more years.

When metastases have developed in the vagina, following a primary growth in the uterus, total extirpation is likely to be soon followed by developments in other parts of the body. Distant metastases, indeed, indicate that treatment can only be palliative.

TUBERCULOSIS IN THE UTERUS.

Tuberculosis in the uterus is generally secondary to the affection in other parts of the body, e. g., the lungs. The corpus uteri is more frequently involved than the cervix. In Merletti's collected list of 172 cases of genital

tuberculosis, the body of the uterus was involved in 75 cases; in Berkeley's 62 cases, in 29 per cent.

Usually it is a direct extension from the tubes. Very rarely is the disease primary in the uterus.

It has been stated by various authors that the puerperal state predisposes to tuberculous infection of the uterus.

The endometrium is first affected, usually in the region of the fundus. Various changes may be found, viz., miliary tubercles with or without ulceration, hyperplastic endometritis, chronic fibroid changes. The cervix is rarely affected. In Berkeley's 62 cases of genital tuberculosis, it was affected in 6.4 per cent. The condition may be mistaken for carcinoma of the cervix. Very rarely

the cervix may be the only portion of the body affected with tuberculosis. Sometimes the canal is blocked, leading to an accumulation of discharges in the uterine cavity, which may be considerably distended.

A positive diagnosis can be made only by cureting the uterus and finding tubercle bacilli or giant-cells in the scrapings.

If the genitals are only or mainly involved, removal of the uterus and tubes should be carried out. If there is considerable tuberculosis in other parts, local applications and cauterization are alone advisable.

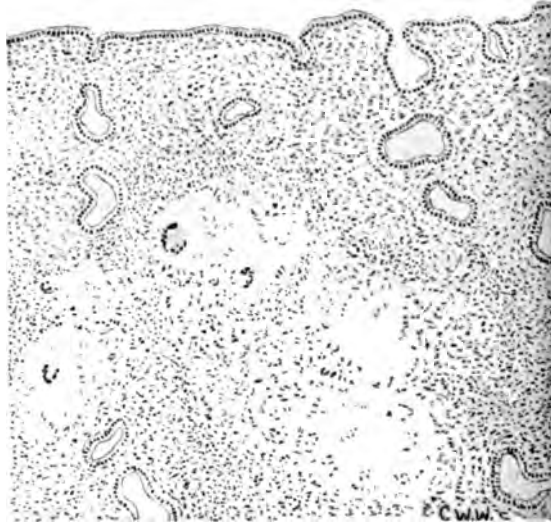


Fig. 337.—Tuberculosis of the endometrium ($\times 96$).

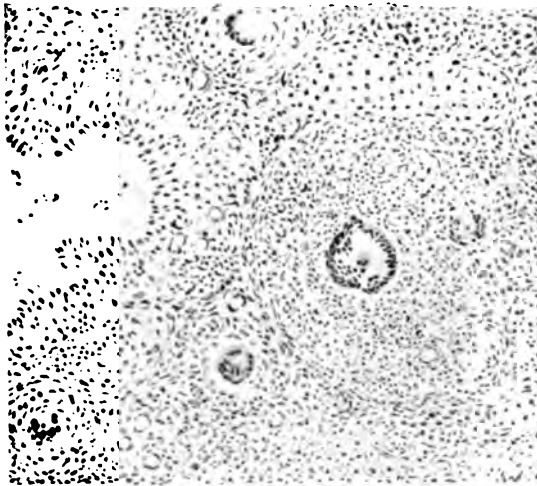


Fig. 338.—Tuberculosis of endometrium ($\times 781\frac{1}{2}$).

SYPHILIS OF THE UTERUS.

The uterus is rarely the seat of primary or secondary syphilis. It is uncertain to what extent it may be affected with tertiary syphilis.

Primary chancre may occasionally develop on the cervix as a single or multiple swelling. It may coexist with chancre elsewhere in the genitalia. The cervical affection is characterized by an ulcer which may be minute or may be half an inch or more in diameter. The edges are indurated and the surface usually covered with a slough. The inguinal glands are not enlarged unless the external genitals are at the same time affected. The intrapelvic lymphatics and glands related to the cervix are usually infected, being enlarged and tender.

Secondary syphilids of the cervix vary in appearance. There may be diffuse congestion, inflammation, or ulceration. Endometritis is usually present, the whole uterus being congested and somewhat enlarged.

Treatment.—Ulcers should be thoroughly swabbed with pure formalin, and the vagina thereafter irrigated twice daily with a weak solution of formalin (30–40 min. to a pint). When there is endometritis, the uterine cavity should be swabbed with formalin one or more times.

The general and medicinal therapeutic measures are the same as in cases of primary and secondary syphilis elsewhere.

ECHINOCOCCUS INFECTION OF THE UTERUS.

The uterus is rarely the seat of echinococcus growth. The organisms may develop primarily in the mucosa or in the parenchyma. The parasites are believed to enter the uterine tissues either through an injured mucosa or to be transported from some distant focus, *e. g.*, the liver. The cyst-wall consists of a structureless, stratified membrane, containing scolices and hooklets. The cysts multiply by endogenous proliferation, the mother-cyst growing to contain numerous daughter-cysts. The tissues may be directly invaded or the parasites may spread by means of the lymphatics. The parent cyst, developing in the latter position, may extend outward toward the peritoneum or inward toward the uterine cavity. The uterus is enlarged, the cyst being smooth and elastic; as it enlarges fluctuation may be obtained in it. Frequently the swelling is mistaken for pregnancy, especially as many of the secondary signs and symptoms of the latter condition may be present. Instead of amenorrhea, however, there is usually an irregular discharge of blood from the uterus. Very rarely echinococcus infection may coexist with pregnancy.

The diagnosis can be made only by demonstration of the hooklets.

Treatment.—If the cyst is easily accessible, it should be opened and thoroughly curetted. It should then be packed for forty-eight hours with gauze soaked in glycerinated solution of formalin (formalin, 40 min.; glycerin, 6 oz.; water, 10 oz.). At the end of this period the cavity may be packed with chinosol gauze. This is renewed several times during the next fortnight, until the cavity gradually shrinks.

In cases in which the uterus is much enlarged or neighboring tissues tend to be invaded, hysterectomy is advisable.

FLUID DISTENTION OF THE UTERINE CAVITY.

The uterus may be found distended in various conditions in which the escape of fluid from its cavity is prevented, *e. g.*, congenital or acquired atresia

of cervix or vagina, new-growths of the uterus obstructing the cervical canal. The swelling caused by the accumulation of blood is known as *hematometra*; that due to pus, as *pyometra*.

When the fluid is clear, it is termed *hydrometra*, and usually consists of a mixture of mucus and serum.

The treatment in such cases consists in giving exit to the fluid and in making an opening of such a size as to prevent a reaccumulation. In cases of congenital atresia the operation may sometimes be difficult and may be complicated by other procedures (see pp. 354, 440, 464).

UTERINE POLYPS.

Different varieties of these are found, *e. g.*:

1. Pedunculated Nabothian follicle (see p. 453).
2. Submucous fibroid (see p. 509).
3. Benign polyp.
4. Fibrous polyp of the mucosa of the corpus uteri.
5. Placental and fibrinous polyps.
6. Sarcoma (see p. 591).
7. Carcinoma (see p. 558).

Benign Polyps.—These grow most frequently from the mucosa lining the cervical canal, being frequently termed mucous polyps. Rarely they develop above the os internum. According to most authorities, they are merely a localized hyperplasia and hypertrophy associated with an inflammatory process. Others regard them as simple adenomata. These polyps vary from a pea to a walnut in size. They are made up of the elements of the mucosa and are very vascular, usually of a cherry-red color. Often more than one are found. They may be sessile or pedunculated.

They are covered with columnar epithelium; when growing near the os externum, they may be partly, or sometimes entirely, covered with stratified squamous epithelium. They are made up of spaces lined with columnar or cubic epithelium, lying in a delicate connective-tissue stroma rich in capillaries; often blood is found diffused among the fibrils. The spaces vary in size and number in different cases. Sometimes there is myxomatous degeneration in the connective tissue.

In some cases, where the spaces are somewhat distended, the lining epithelium may be considerably flattened. They contain thick or thin mucus.

As these polyps grow and descend, they dilate the cervix. Sometimes



Fig. 339.—Small multilocular cystic polyp growing from the vaginal portion of cervix.

those growing in the body do not tend to work their way down through the cervix.

They sometimes tend to recur; Olshausen, Breisky, and others have stated that they tend to precede malignant growths. Abel points out that this is mainly true of those whose covering is partly or entirely composed of squamous epithelium. The projections of squamous epithelium may sink more deeply than normal into the connective tissue and simulate an early malignant change.

Sometimes these growths may have a covering of stratified squamous epithelium, though growing from the cervical mucosa.

Diagnosis.—Menorrhagia and metrorrhagia occur. Hemorrhage is apt to occur after violent exertion, straining at stool, coitus, physical examination, in cases in which the polyp hangs in the vagina. Leukorrhea is common. The mucopurulent discharge may be from the tumor as well as from the uterine mucosa. Pain is rare, save when the tumor is large and has not passed through the cervix; it is chiefly present at menstruation.

Anemia is often rapidly brought about; the patient may even have a cachectic appearance in some cases, which may increase the suspicion of malignancy.

Sterility may be present, due, perhaps, to plugging of the cervix or to associated inflammation in the mucosa.

Sometimes with these, as with other polyps, pigmentation and enlargement of the breasts, morning sickness, etc., may be present. When the polyp extends beyond the cervix, it is felt as a soft, velvety mass. If it does not project much, it may be mistaken for a catarrhal patch; sometimes for malignant disease, especially if ulceration or gangrene be present. Through the speculum the mass is seen to be of a cherry-red color.

When the growth is within the uterus, it may be easily overlooked, and the symptoms may be considered as being due to other conditions. Frequently patients are allowed to go for a long time with the condition undiagnosed. In doubtful cases the cervix must be dilated, and the cavity carefully explored with sound, finger, or curet. With small polyps the uterus is not necessarily much enlarged.

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Fibrous Polyp of the Mucosa of the Corpus Uteri.—Haultain has described an interesting case in which, in an old woman of seventy, a series of large polyps developed from the mucosa of the body, leading to hemorrhages. They consisted of fibrous tissue in the center, and of more cellular tissue near the periphery, containing canals, evidently gland-like spaces; they were covered with columnar epithelium. These polyps verge toward sarcoma.

Placental and Fibrinous Polyps.—Remains of membranes or placenta may give rise to a coagulation of blood, which may undergo partial organiza-

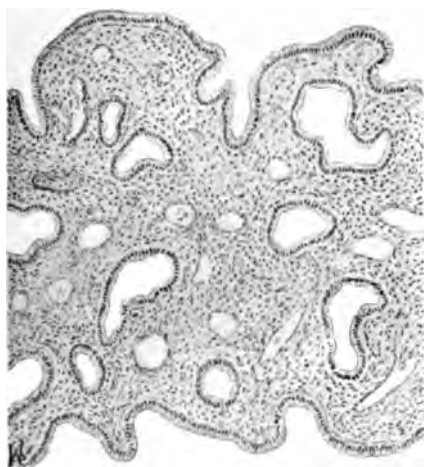


Fig. 340.—Section through a "mucous" polyp ($\times 90$).

tion, forming a large mass which may hang from the wall of the uterus like a polyp. It tends to undergo decomposition, giving rise to a fetid discharge.

Fibrinous polyps may sometimes be developed independent of the puerperal state. They may sometimes develop on the site of removal of a large intra-uterine polypoid tumor, the fibrin becoming deposited, layer upon layer.

Diagnosis.—There are irregular losses of blood, which may be very profuse. Other symptoms are due to the subinvolution. When decomposition occurs, the condition may be mistaken for malignancy.



Fig. 341.—Section of uterus from a woman of sixty-five. The cavity is occupied by an elongated polyp attached to the fundus. On microscopic examination it had an adenomatous appearance, many small cysts being present.

Treatment.—The method of dealing with polyps varies according to the nature of the swelling.

Mucous polyps may be removed by grasping the pedicle with forceps close to the uterine attachment and twisting it. Afterward the whole uterus should be thoroughly curetted. Fibrinous and placental polyps are removed with curet and curet-forceps. The treatment in the case of the other varieties mentioned is described in the chapters in which they are considered.

CHAPTER XIX.

AFFECTIONS OF THE URETHRA AND BLADDER.

URETHRA.

Developmental Defects.—Absence of the whole urethra sometimes occurs; this may be found with or without other malformations. The bladder may open by a slit into the lower part of the vagina in such cases. Sometimes only the inner portion may be wanting; sometimes the outer; sometimes the middle portion.

Epispadias, or defect of the upper wall of the urethra, may be found without any corresponding affection in the bladder, but usually this viscus is also involved. The whole or outer part of the urethra is found as an open groove. On each side lies one-half of the split clitoris, with its corresponding labium minus. The labia majora may be joined normally in the anterior commissure, or may be divergent. There may be a scanty growth of hair on the mons veneris. The bladder is generally smaller than normal, and usually the symphysis is closed.

Symptoms.—Incontinence of urine is the chief feature. This may be continual, but usually it is marked only when sudden movements are made. The genitals become tender and excoriated. Menstruation usually continues, however, and pregnancy may take place.

Treatment.—A plastic operation should be performed for the purpose of closing in the deficiency. If this fail, a urinal requires to be worn continually.

Hypospadias occasionally occurs. This may be found as a mere deficiency of the posterior wall of the urethra; more commonly it exists as part of the condition known as persistence of the urogenital sinus (see p. 329).

Dilation of the Urethra.—This condition may affect the whole or the outer part of the urethra. It may be caused by coitus, where the vagina is defective, or it may be brought about by means of a tumor in the passage. It sometimes remains after artificial dilation.

Treatment.—In slight cases, in the hope that cicatrization may cause shrinkage, longitudinal furrows may be found along the dilated portion. If this method fail, or if the dilation be considerable, a plastic operation may be tried, a portion of the posterior wall being cut out and the raw edges brought together.

In extreme cases Gersuny's plan should be adopted. The urethra is dissected free in its entire length, twisted on its long axis from 180 to 360 degrees, and stitched in this position. The bladder is drained with a self-retaining catheter.

Frich advises the removal of a portion from the upper part of the anterior wall of the urethra after the latter is separated from the pubes. The opening is then closed and a self-retaining catheter placed in the bladder.

Another procedure has been recommended in cases of moderate dilation,

viz., freeing the outer end of the urethra, carrying it forward, and stitching it to the edges of a new opening in the vestibule.

Stricture or Stenosis of the Urethra.—This may result from cicatrization, after severe labors, or from the presence of a new-growth. It may gradually form in vesicovaginal fistula. Sometimes it follows gonorrhea. It may also develop after operations on the urethra.

Treatment.—If no tumor exists, gradual dilation with bougies is to be carried out. Sometimes it is necessary as well to cut the cicatrix from without.

Urethritis.—Inflammation in the urethra is generally due to gonorrhea. It may follow the use of dirty instruments, injuries, the irritation of a new-growth, masturbation, awkward coitus.

The mucosa swells, becomes congested, and a catarrhal discharge is produced.

When acute gonorrheal infection is the cause, there is usually first an itchiness about the urethra, then a prickling, burning pain; there are frequency of micturition and dysuria; in three or four days a sticky secretion oozes out, and then an abundant purulent discharge. In about twenty days this begins to decrease, and it may entirely disappear in thirty or forty days. Sometimes there may be blood in the discharge. Catarrh of the bladder may also be present. Skene's glands and the pits around the meatus may remain affected for a long time. Prolapse of the mucosa may take place.

Treatment.—(See pp. 335, 349.) Red patches sometimes exist in the urethra, which cause pain on micturition or on the passage of instruments. Their nature is not well determined. They may result from old inflammation or may be similar in structure to a caruncle. They should be thoroughly cauterized.



Fig. 342.—Caruncle completely occupying the orifice of the urethra.

Urethrocele (Urethral Diverticulum).—This is a condition in which a pouch exists between the vagina and urethra, communicating with the latter by a small opening in its posterior wall, usually about the middle third. There is a difference of opinion as to the etiology. Sometimes an abscess or hematoma in the vesicovaginal septum may burst into the urethra. Possibly cysts may develop as a result of the closure of urethral gland-ducts. Routh thinks that Schüller's glands may give rise to them. Suppuration taking place in the cyst probably leads to the development of a communication with the urethra.

In some cases there may be a true diverticulum of the mucosa through a flaw in the muscular wall, similar to the condition sometimes found in the intestine. Inflammation and suppuration may occur in it, and lime salts may be deposited. Possibly in some cases the neck may be closed so that a cyst is formed external to the urethra; this may enlarge considerably.

Retention cysts are sometimes found near the external urethral orifice, being probably derived from Skene's tubules.

This condition may cause a feeling of discomfort, as of something pressing down; there may be dysuria; sometimes there is incontinence when sudden movements are made; dyspareunia may be present.

Treatment.—The anterior vaginal wall should be incised, the cyst removed, and the opening closed with continuous catgut suture. In most cases it is well to drain the bladder with a rubber catheter for four or five days after the operation.

Retention cysts are sometimes found near the meatus; they are probably due to closure of the outer ends of Skene's glands.

Fissure of the Urethra.—This condition is sometimes found at the inner end of the urethra. It is a very troublesome condition, and may cause much discomfort and pain, especially in connection with micturition.

Treatment.—At first dilation of the urethra should be tried. The function of the sphincter is destroyed for a time, and, during this period of rest, the fissure, which has been stretched, has a chance to heal. Along with the dilation the application of the cautery to the fissure by means of an endoscope is made by some operators. If these methods fail, the establishment of a vesicovaginal fistula for a time may be necessary.

Caruncle.—The urethral caruncle is common. It occurs most frequently in married women during middle life. It may vary in size from a pea to a hazel-nut, and forms a deep-red mass at the urethral orifice, usually on the posterior wall. It may be sessile or somewhat pedunculated. Usually only one is present, but sometimes there may be more than one.

Lange has made a study of 58 cases, and classifies them as follows:

Nineteen simple granulomata.

Nineteen papillary angiomas or hypervascular papillary polyps, covered with stratified epithelium.

Twenty simple angiomas, teleangiectatic mucous polyps, containing thin-walled blood-vessels and spaces lined with low cubic epithelium. Lange thinks that nearly all caruncles are inflammatory in origin.

Williamson has recently made an elaborate study of caruncles and groups them as follows:

1. Granulomata, of infective origin.
2. Benign new-growths, composed of the tissues which normally occur in

the region of the meatus. They have an epithelial covering, a basis of connective tissue in which are embedded glands similar to the periurethral glands, and numerous vascular spaces. These tissues vary considerably in their arrangement and relative proportions in different cases.

The swelling is usually sensitive to touch and may cause pain on coitus, walking, or sitting; there may be dysuria and frequency of micturition. It sometimes bleeds on being irritated.

Treatment.—It should be thoroughly burned off with a cautery at a dull red heat. If there should be much after-bleeding, a plug of gauze held against the spot by a perineal band acts as a hemostatic.

Other Growths.—Fibroma and fibromyoma rarely develop from the wall of the urethra. Small ones may project into the urethra, or the growth may be external. Primary sarcoma and carcinoma are very uncommon. Syphilis sometimes produces changes simulating malignant disease.

Tuberculosis very rarely begins in the urethra.

Displacement of the Urethra.—The whole urethra may be altered in position following displacements of the bladder and anterior vaginal wall. Kleinwächter describes two varieties of prolapse of the urethral mucosa, one in which the mucosa near the meatus is everted, the other in which it becomes loosened higher up, gradually extending down until it appears at the meatus. A. R. Simpson has described two interesting cases of the former condition: in one of these it developed suddenly, following a fall; in the other it was caused by the dragging down of a caruncle as large as a cherry. Inflammatory changes may take place, and erosion or ulceration or gangrene be caused. The prolapsed mucosa may in old cases sometimes take on a skin-like character.

I examined Professor Simpson's cases microscopically, and found that in both cases the epithelium covering the prolapse was transitional, like that



Fig. 343.—Marked eversion of urethral mucosa.

the upper portion of the urethra. Cross-sections resembled the structure of a caruncle, and in the second specimen it was impossible to say where the caruncle began and the prolapse ended. It is, indeed, possible that a caruncle may begin as a localized prolapse.

The *symptoms* vary. Sometimes there is no discomfort. In other cases they are the same as in caruncle. Sometimes the patient complains only of hemorrhage.

Treatment.—The prolapsed portion may be cut off, and the edge sutured to the margin of the urethra.

In the case of prolapse of the upper portion of the mucosa, it may be necessary to split open the urethra in order to remove the redundant portion.

Varicose Veins.—These are sometimes found, especially near the meatus, forming small swellings resembling hemorrhoids. As a rule, they are not tender.

BLADDER.

Malformations.—**Epispadias** is rare in the female. In one variety the deficiency in the anterior urethral wall exists along with ectopia vesicæ or extroversion of the bladder. There is a failure in development of the anterior wall of the bladder and of the anterior abdominal wall in front of it. There is also a deficiency in the pubic arch in the majority of cases.

The posterior bladder-wall appears as a red surface which bleeds easily. The openings of the ureters may be seen, from which urine escapes in small irregular jets. Here and there the mucosa has epidermic characters; at the edge of the red area the mucosa joins the skin. The skin is marked by cicatrices, supposed to be the remains of the allantois. The ectropion may reach up to the umbilicus.

The labia and halves of the clitoris are separated. The vagina and uterus are occasionally double. The sacrum usually projects well forward. The ureters bend down into the pelvis before passing up toward the kidneys. They may be elongated and distended.

In some cases the bladder is not involved. The anterior urethral wall is deficient in greater or less extent, the clitoris is divided, and there is a vertical groove in the anterior commissure of the vulva. The pubes is intact.

There is a rarer condition of ectropion in which the whole cloaca opens anteriorly, the bladder not having been developed to any extent. Variations may be found between this and the first-mentioned form.

Symptoms.—Usually the patient is run down in health. There are constant dribbling of urine and much local discomfort. Excoriation, inflammation, and ulceration may develop on the vesical mucosa or skin; the ureters may become affected, and the kidneys get diseased. Sexual appetite is usually absent, though pregnancy may occur. Menstruation is irregular. In slight cases in which only a small part of the urethra is involved there may be no incontinence.

Treatment.—Previous to any attempt at operative treatment the health of the patient should be made as good, and the local conditions as favorable, as possible. When the urethra is deficient, it should first of all be restored by a plastic operation.

Afterward the malformation in the lower abdominal region is closed. If

there be a mere fissure, the edges should be pared and stitched together. If there be considerable deficiency in the anterior abdominal wall, a plastic operation should be undertaken.

Flaps are made from adjacent parts of the abdominal parietes and turned inward over the opening, their edges being stitched together and to the pared edges of the opening. In this way the skin surface forms the new anterior wall of the bladder. The flaps may be taken from above and from each side of the opening, or one large one may be taken from an inguinal region.

Some prefer, after making the flaps, to cover the raw surface with skin-grafts. Afterward, at a second operation, the edges of the flaps and of the opening are brought together. If the skin-grafting is not undertaken, it is necessary to dress the raw surface carefully with iodoform collodion. If these attempts fail, an artificial urinal should be worn.

Hypospadias.—This term is applied to cases in which the urethra opens into the vagina above its normal site. The condition is really one in which there is persistence of the urogenital sinus. There is deficiency of the urethra posteriorly.

In some cases there is incontinence of urine; in others this is absent.

In the former instance treatment should consist in freeing of the entire urethra, closure of the defect, and the carrying-out of Gersuny's procedure, described above.

Double Bladder.—Two bladders are very rarely found (see p. 328). Sometimes the single bladder has a median partition, large or small, or it may be found with sacculations.

Absence of the bladder is sometimes met. The ureters may open, in such a case, into urethra, rectum, or vagina, or through the abdominal wall.

Cyst of the Urachus.—The accumulation of fluid in a portion of the urachus may give rise to a cystic swelling. This may reach a large size, and may be mistaken for an ovarian or parovarian cyst. It usually develops very slowly and occupies a median position. In some cases the connection with the bladder may not be evident. The fluid rarely has any urinary elements, and is probably derived from the wall of the sac.

Vesico-umbilical fistula is formed by a patent urachus. It is usually noticed as a congenital condition, though in some cases it has developed after the urachus has been closed at the navel, due to some interference with the normal outflow of urine from the bladder. In all such cases the urachus should be dissected out of the abdominal wall and closed near the bladder, care being taken to insure free evacuations of urine through the urethra.

Displacements.—The bladder may be displaced in various ways by tumors. It may be dragged downward by prolapsus uteri or by supravaginal hypertrophic elongation of the cervix; in cystocele; by old cellulitic or peritonitic cicatrizations. It may form a hernia into the inguinal, femoral, obturator, or sciatic foramen; sometimes it may bulge into the abdominal wall at the scar of an old laparotomy incision or of a healed abscess, or if the muscles be weak or separated in the middle line.

Where the bladder becomes herniated, it tends to become sacculated; urine may collect in the protruding part, decomposition follow, and calculus perhaps develop. The bladder is also somewhat displaced in labor.

Prolapse of the vesical mucosa through the urethra is sometimes found. Rarely the whole bladder-wall may thus prolapse—inversio vesicæ.

Cystocele.—This condition has been considered under "Downward Displacements of the Pelvic Floor" (see p. 311). It is not uncommon in fat multiparæ with pendulous belly and in women after the menopause.

Hyperemia.—Capillary dilation may be found in the bladder in various portions. It is present in cystitis, but may be found apart from the latter. Thus it may be associated with inflammation or congestion in neighboring structures, or may be caused by various irritants, *e. g.*, catheterization, concentrated urine, etc. It is perhaps most frequent in the trigone.

The patient usually desires to urinate frequently; there may be a sensation of burning, bearing-down, or of fulness. Urination is sometimes painful, during the act or afterward. Kelly states that the condition is found in cases diagnosed as "irritable bladder," "neuralgia of the bladder," and in cases in which ante flexion or retroflexion of the uterus is supposed to press on the bladder. The condition is recognized on direct inspection of the bladder, the affected area being abnormally red.

Treatment.—The cause should be removed, *e. g.*, a displaced uterus should be corrected. Diluent drinks should be given. The diet may require to be altered. Kelly recommends sweet spirits of niter. The hot vaginal douche may give relief. Sometimes direct application of a 3 to 5 per cent. solution of silver nitrate to the affected area is beneficial. Air-distention of the bladder may also be carried out on several occasions.

Varix.—Varicose veins are rare in the bladder-wall. They may be found on direct inspection. Hemorrhage may result.

Inflammation in the Bladder—Cystitis.—*Pathology.*—Cystitis may be acute or chronic. In most cases the inflammation begins in the mucosa and is mainly limited to it, though, sometimes, the wall may be infected from the outer surface. The entire mucosa or single or scattered areas may be affected.

In *acute* cases there are congestion of the mucosa, proliferation, cloudy swelling, and shedding of the epithelium, while leukocytes and serum are poured out of the dilated capillaries. Inflammatory products may be also found in the neighboring part of the wall. Small hemorrhages may be produced, and erosions may occur. This condition may become chronic, may get well, or may give rise to ulcers, abscesses in the wall, or to a gangrenous condition. Sometimes a croupous membrane forms. The ulcers may be linear or small and irregularly rounded.

When gangrene takes place, exfoliation of a large area of the mucosa or even of the muscular part of the wall as well may result.

In *chronic* cases the mucosa is generally of a grayish color, irregularly mottled in parts, and covered with a layer of pus. It is increased in thickness; the covering epithelium is considerably altered from the normal and exfoliated; ulcerations may be present; the wall outside the mucosa is somewhat hypertrophied, owing to infiltration with inflammatory products, so that its capability of expansion may be greatly diminished. In some cases a croupous false membrane forms on the surface, composed of fibrinous material, or, sometimes, of proliferated epithelium. It may extend up the ureters—to the kidneys sometimes. Rarely villous projections may form on the wall—the

so-called "villous cystitis." In many cases phosphatic deposits are found on the mucosa.

Etiology.—It is extremely likely that the active factor in causing cystitis is micro-organismal, though in many cases it is probable that there is some associated favoring condition. It has been demonstrated that various pathogenic organisms may be present in the bladder without causing cystitis. The microbes most frequently enter by way of the urethra, with or without inflammatory changes in the urethra, *e. g.*, gonorrhea; they are often introduced by the use of dirty instruments in catheterizing and in performing operations. They may be carried from the kidneys along the ureters. They may enter the wall directly from adjacent affected tissues or sometimes may be carried by the blood or lymph.

Various microbes may set up cystitis, one of the most common being the colon bacillus. Tubercle bacilli, staphylococci, and *Bacillus proteus vulgaris* are often the cause. Staphylococci are usually the agents in puerperal cases. In infection from gonorrhea the gonococcus is rarely found in the bladder, streptococci or staphylococci probably being usually associated infective agents. Various other germs causing suppuration may sometimes be found. The typhoid bacillus is rarely a cause of infection. The colon bacillus, gonococcus, tubercle bacillus, and the streptococcus do not decompose urea. Most of the staphylococci and the proteus of Hauser decompose it, producing an ammoniacal urine.

Various conditions tend to depress the vitality of the wall and to favor infection, *e. g.*, pressure of the fetal head in labor, of a tumor or of a vaginal pessary; chronic congestion in the pelvis, as in metritis; inflammation outside the bladder; downward and backward displacements of the uterus, especially in early pregnancy; foreign body in the bladder; overdistention of the bladder; cold, excessive coitus, poor health, rheumatism, gout, tubercle, certain drugs, *e. g.*, cantharides, excess of balsams, quinin, iodids.

Kolischer has drawn attention to post-operative cystitis in cases in which there has been interference with the bladder and lower end of the ureters, *e. g.*, separating these. He says that desquamative catarrh follows any procedure interfering with the integrity of the wall. Trophoneurotic influences also play a part.

Symptoms and Physical Signs.—In *acute cases* there is painful and frequent micturition. There is a feeling of weight and fulness in the pelvis, and if the patient tries to retain urine, sharp, darting pains occur in the region of the anus. Rectal tenesmus is often found, occurring at intervals. After emptying the bladder, pain may continue for a time. Palpation by the vagina or rectum causes pain; also the introduction of a sound into the bladder. There is often no rise in temperature; if this takes place, it may point to an extension of the inflammation up the ureters or outside the bladder-wall. The urine is diminished, highly acid, and contains epithelial cells, blood, pus, mucus, urates, uric acid, etc. Slight traces of blood are occasionally found. When the pus is uniformly diffused through the urine, there is probably an extensive affection of the mucosa; when the first and last portions of the urine contain it most abundantly, the neck and base are probably affected.

In *chronic cases* the symptoms may begin gradually or may follow an acute attack. The symptoms are those already described, only modified. In old

cases the patient gets thin and worn, and the whole system runs down. There may be pain on coitus.

The urine contains mucus and pus in various quantities. It may be alkaline, having a somewhat strong, unpleasant smell, decomposition being easily set up in it. On bimanual examination some pain is caused when the bladder is pressed between the fingers. It may be felt to be thickened. In old-standing cases, owing to the hypertrophy of the wall, the bladder may feel like a tumor.

Cystitis must be diagnosed from tuberculosis of the bladder or kidney, pyelonephritis, neuropathic vesical conditions, cystocele, tumors, calculus, hyperemia of the trigone, urethritis, pressure of tumors and other swellings outside the bladder, which cause frequency of micturition; hyperacidity of urine.

In all doubtful cases the interior of the bladder should be carefully examined in the elevated lithotomy position (see p. 169).

Treatment.—If any condition exists which tends to keep up the disturbance in the bladder, *e. g.*, calculus, renal infection, etc., it should be attended to. In *acute cases* the patient should be placed in bed, the bowels kept open, and a diet of milk and diluent drinks administered. A mixture containing liquor potassæ, hyoscyamus, and buchu often relieves pain considerably. Sometimes morphin suppositories must be used on account of the pain. Hot hip-baths are often beneficial.

After the acute stage has passed, daily irrigation with warm normal saline solution containing formalin (5 min. to 1 pint) may be carried out.

In the most severe cases some authorities recommend dilation of the urethra, or making an opening into the bladder through the anterior vaginal wall, in order to give the viscus thorough rest.

In chronic cases the bowels should be carefully regulated; milk diet and diluent drinks should be given, alcohol being avoided. Salol or urotropin may be given internally. The latter acts best in an acid urine. Hutchinson advises giving acid sodium phosphate (monobasic) by the mouth, to insure acidity and to prevent the deposition of phosphates.

Direct medication of the interior of the bladder is often of great service. This is most satisfactorily carried out when the patient is placed in the elevated lithotomy posture, though the genupectoral position may also be employed. Inflamed areas or ulcers may be swabbed at first with silver nitrate solution (5 per cent.), a weaker solution being used at intervals of four to five days. Ulcers may be touched once or twice with pure formalin, care being taken not to apply it to any other part.

J. G. Clark has advocated balloon dilation of the bladder in certain chronic cases, the application being continued for ten to twenty minutes and repeated every third or fourth day. The author has obtained benefit from the air-ballooning obtained by placing the patient in the extreme elevated lithotomy posture and opening the urethra.

In obstinate cases of this condition, when the ordinary medical treatment is inefficient, continual drainage of the bladder may be tried. This may be carried out by dilation of the urethra by means of a series of graduated dilators. The action of the muscles which close the urethra is interfered with for a time. If the muscles regain their power too soon, another dilation should be per-

formed. If too much dilation be made, permanent paralysis of the urethra may remain. A diameter of 20 mm. is the usual limit in an adult. The patient remains in bed. During the day she may rest against an inclined plane, so that the back is somewhat elevated. Once or twice daily a weak formalin saline douche is given.

Drainage may also be carried out by means of a retaining catheter. This is preferable to the former method, especially in young and elderly women in whom dilation of the urethra is most apt to produce permanent weakness. The catheter should be changed every few days in order that salts may not become deposited on it. When the urine tends to deposit phosphates, it is advisable to irrigate the bladder every day or two with a solution of citric acid (8 or 10 grains to a pint). When drainage by the urethra fails to cure the case, an artificial opening should be made through the anterior vaginal wall. The patient is placed in the lithotomy position. The cervix is pulled down, and the anterior vaginal wall held steady with volsellas.

A sound is passed into the bladder, the point being made to press the base forward just above the inner end of the urethra. A mesial incision is then made through the anterior vaginal wall and the base of the bladder, the knife cutting on the point of the sound. With a pair of scissors this incision is lengthened upward for about three-quarters of an inch. A finger is introduced to feel the condition of the bladder-wall. If any crystals of lime are attached to the wall, they should be removed. The bladder is next washed out. Then, with small full-curved needles and catgut sutures (No. 2), the vesical and mucosal edges of the wound are united all around the opening. The patient remains in bed, daily vaginal antiseptic douches being given.

When the patient is cured, the fistula is closed, according to the method described on p. 625.

Tuberculosis of the Bladder.—This disease may be found at all times of life; it is more common in women than in men. Very rarely is it limited only to the bladder: there is usually tuberculosis elsewhere in the body. Miliary tubercles develop in the mucosa, and in advanced stages caseation occurs, leading to ulceration in a large area or in several small ones. The ulcer has sharp, irregular edges, a granulating base, and is usually surrounded with small hemorrhagic foci. The trigone, base, and posterior wall are most frequently affected, but the entire bladder may be involved; when the infection is introduced from a kidney, the bladder is apt to be first involved near the ureter of the diseased kidney.

Frequently, accompanying cystitis may be caused by other organisms, *e. g.*, staphylococci, gonococci. Indeed, Rovsing holds that tubercle bacilli cannot set up tuberculous cystitis in a healthy bladder, but only in one injured or inflamed. The disease may extend down the urethra or perforate vagina and rectum. It may lead to an abscess outside the wall, which may burrow and open in different directions. The bladder tends gradually to shrink up behind the symphysis; its walls may become sclerosed and the muscle atrophied, so that the viscus loses its power of contracting and expanding. The disease may spread to ureters and kidneys. Frequently, however, the bladder is infected from disease in the kidneys.

The early *symptoms* are frequency of micturition after meals and at night; afterward, in the daytime as well. Slight traces of blood appear in the urine.

Pain gradually develops, and pus is produced. All the conditions of chronic cystitis are then found. Sometimes there may be reflex spasms of the walls of the urethra, causing retention. Where ulceration destroys the neck of the bladder to a considerable extent, there may be incontinence. The pain varies greatly; it is sometimes slight, but usually severe, being felt in micturition or continuously. Sounds should not be passed for diagnosis in this disease, because of the danger of injuring the wall. The urine usually contains tubercle bacilli, but these may not be found if there be much pus. The reaction is acid unless other organisms are present which break up urea.

If a portion of the edge of an ulcer be removed, the tubercle bacilli may usually be found in it.

Treatment.—The general treatment is the same as for tuberculosis elsewhere. Articles of diet and drugs which irritate the bladder should be avoided, *e. g.*, alcohol, spices, cantharides, nux vomica, etc. Morphin may be often necessary. Local treatment often consists in washing out the bladder with the formalin saline solution above mentioned. The bladder should be examined in the elevated lithotomy position, and the ulcerated areas burned lightly with the actual cautery or cureted and swabbed with pure formalin.

Some authorities advise that the latter procedures should be carried out through a suprapubic opening into the bladder. In cases which resist these methods the author has found it advisable to establish a vesicovaginal fistula for an indefinite period, vesical and vaginal irrigations being thereafter given. This procedure may sometimes be followed by cure, so that the opening may again be closed.

Necrosis of the Bladder.—This condition has been studied by several workers. Haultain states that it may be brought about by traumatism, local poisons, and interference with the circulation. Thus, it may be found as a result of retroflexion of the gravid uterus, the pressure of the fetus in a delayed labor, distention of the bladder, cystitis, etc. It is extremely probable that in most cases the action of microbes is an important factor.

The mucosa alone may be affected, or the mucosa and submucosa; sometimes these along with the muscular coat, or, indeed, the whole thickness of the wall. The latter may be perforated; exfoliation of the dead tissue may occur, and this may be followed by the opening.

Clinical Features.—They differ considerably. The temperature varies in different cases; it is always raised when exfoliation takes place. Retention and incontinence of urine are often found. The urine contains much debris and is usually ammoniacal. The exfoliated portion may protrude as a non-vascular, foul-smelling mass. It may be mistaken for an inversion of the bladder, which has not, however, these characteristics.

Treatment.—When exfoliation is taking place, the urine should be drawn off and the bladder washed out every few hours with a strong antiseptic. If there is a tendency to retention of urine, it is best to make an opening into the bladder through the anterior vaginal wall.

Calculus in the Bladder.—This condition is rarer in women than in men—5 to 100, according to Auvard. The causes of stone are not so often met in women, and, owing to the shortness and dilatability of the urethra, small calculi may easily be passed from the bladder.

Etiology.—A stone may pass from the kidney and increase in the bladder.

Cystitis and decomposition of urine may give rise to it. It may develop in connection with foreign bodies or tumors in the bladder, in conditions where a culdesac may form in which urine may gather and decompose, *e. g.*, sacculated and herniated bladder, prolapse.

Pathology.—There may be only one or many, and great variations in size are found. They are of different shapes; when several exist together, they are usually faceted. The surface is smooth, granular, or rough.

Oxalate of calcium usually forms in rounded, nodulated, slate-colored masses.

Calculi of uric acid and ammonium urate are ovoid and somewhat flattened, with a smooth or granulated surface, the uric-acid masses being yellow. Phosphatic calculi are irregular in shape, as a rule, and of a gray-white color. Mixed forms may be found.

Symptoms.—Pain is often present. It may be constant in some cases, probably where there is cystitis. Generally the pain is felt after jumping, walking, driving, riding, etc. It is usually eased when the patient lies down. Where the stone is of some size, there may be much pain in the bladder, urethra, perineum, loins, groins, or in the legs, owing to the contraction of the bladder on it. There is frequency of micturition; sometimes the flow is stopped suddenly. Hematuria is an important symptom; it usually occurs after much exertion, or after driving, riding, etc.

In some cases of small stone there may be no symptoms, or very slight ones. Sometimes they may be passed spontaneously through the urethra.

Physical Signs.—On bimanual examination it may be possible to feel the mass or masses in the bladder. With a sound they may be felt when the instrument is introduced into the viscus.

Treatment.—Small stones may sometimes be removed through a dilated urethra by means of a pair of slender forceps. It is, however, more satisfactory to dilate the bladder with air in the elevated lithotomy posture and to remove the calculi through a short speculum.

A stone of moderate size may be crushed with a lithotrite, the débris being washed out.

If there be much cystitis, or if the stone be too large or too hard to allow of crushing, it must be removed by an opening through the anterior vaginal wall or by suprapubic cystotomy. The former method is to be chosen, save when it is not possible to adopt it. The patient is placed in the lithotomy position, the vagina well exposed with specula, the cervix pulled down, and the anterior vaginal wall fixed.

If necessary, a sound is passed into the bladder as a guide to the knife. The incision is made in the middle line as long as is necessary. The stone is then removed *en masse*. It may be crushed if it is too large to extract otherwise. The interior of the bladder should be carefully washed out and then explored with the finger. If there be little or no cystitis, the wound should be closed with catgut sutures (No. 2 or 3), as in the case of repair of a vesico-vaginal fistula (see p. 625). The after-treatment is the same as in the case of a fistula repair.

If marked cystitis be present, it may be necessary to close only the upper part of the wound, leaving the lower part open to act as a drain for a few weeks. When the patient has recovered, complete closure can be carried out.

Neoplasms of the Bladder.—New-growths are most frequently found in the region of the trigone, next on the posterior wall, then at the neck, and, finally, on the anterior and lateral walls (Auvard). The benign tumors are usually rounded and localized, the malignant more diffused. The latter are the most frequent, carcinoma being in greatest preponderance.

Carcinoma may be found in its various forms. It is usually secondary to rectal, vaginal, or uterine cancer; it may, however, be primary. It may grow from a single nodule, or several nodules may fuse; it tends to infiltrate widely, and ulceration occurs in the mucosa over it. As a rule, cancer of the bladder grows slowly.

Sarcoma is rare; it tends to break down and to extend widely. Myoma, fibroma, and myxoma are sometimes found; the latter are pedunculated and are sometimes termed *mucous polyps*.

Papilloma is found either as a stalk with long, villous projections, composed of delicate, vascular, connective-tissue stroma, covered with epithelium, or as a sessile or pedunculated warty growth of firm consistence; the latter may be single or multiple, and varies in size from a pin's head to a walnut. This is the most common benign growth.

Angioma, *dermoid cysts*, and *simple cyst* may sometimes be found in the wall.

Bilharzia haematobia in the tropics sometimes leads to the formation of fungating masses in the bladder.

The following changes may be found as a result of new-growths in the bladder: Deposit of salts on the growth, formation of calculus, cystitis, hydronephrosis, nephritis, pyelonephrosis, hypertrophy of bladder-wall.

Symptoms.—In some cases of benign tumor there may be no symptoms. Usually, however, hematuria, pain, and micturition troubles are present, though varying greatly in their severity in different cases. The most important of these is hematuria. It may appear at any time in small or large quantity, and is not related to strains or jolts. It may last for hours, days, or weeks, and then suddenly disappear. The blood is more marked at the end of micturition usually. In cases where the blood-loss is slight, the patient may notice the darkening of the urine, most marked in the morning.

Where the blood-loss is great, clots may form. The patient may become very anemic and somewhat cachectic even when the tumor is benign, and the legs may become edematous. Pain usually appears late, and is mostly due to cystitis; but it may be caused by the infiltration and extension of malignant disease. Micturition is frequent, and in some cases painful. The flow may be stopped by a clot or by a piece of the tumor; sometimes there is much difficulty in emptying the bladder.

Physical Signs.—Sometimes a small tumor may be seen projecting out of the urethra. On bimanual examination, especially under anesthesia, the neoplasm may sometimes be distinctly felt. When small or soft, it may be missed in this way. On examination of the interior by the Kelly method the growth may be seen. On dilating the urethra it may be felt with the exploring finger.

A valuable aid in diagnosing the source of blood is distention of the bladder with aseptic water; if, on expulsion, the fluid be followed by hemorrhage, the vesical origin of the blood is indicated. Sometimes, where the neck of the

bladder is affected, blood flows through the catheter as it is introduced or removed.

Treatment.—The treatment depends on the size and situation of the tumor. Sometimes small pedunculated growths may be twisted off through the dilated urethra.

Larger growths may be removed by means of a vertical mesial incision through the anterior vaginal wall and base of the bladder. The tumor should be removed with the cautery at a dull red heat. The opening into the base may then be closed. For large growths the operation of suprapubic cystotomy may be employed. This operation is performed as follows: The patient is prepared as for an abdominal section. She is placed in the dorsal or Trendelenburg position. It is usual to distend the bladder or rectum with air or warm sterilized water (100° F.) in order to push up the peritoneum as much as possible. Some think it is unnecessary and even dangerous to distend the bladder when there is disease in its wall. If it be not distended, it should at least be filled. The rectum is best distended by an inflated rubber bag.

A vertical mesial incision, 2 or 3 inches in length, is made through the skin and superficial fascia immediately above the symphysis. It is then carried transversely across the top of the pubes. The origins of the recti and pyramidales muscles are divided a short distance above the bone. The thumb and finger are passed behind the symphysis, the peritoneum being separated somewhat from the bone if it be attached, and the extraperitoneal tissues in the region of the apex of the bladder drawn upward.

A loop of silk-worm-gut or silk is now passed through the thickness of the muscular wall at the lowest part of the bladder, which can be reached behind the symphysis. Another is passed higher up, just below the attachment of the peritoneal reflection. The wall of the bladder is divided vertically between these fixation loops until the vesical mucosa is seen as a bluish membrane. All bleeding is checked, and the mucosa is incised with a bistoury. The finger is quickly introduced to prevent escape of the contained fluid, and the bladder is explored. The opening may be enlarged according to requirements of the case. Sometimes it may be necessary to resect a triangular portion of the symphysis subperiosteally, in order to obtain room. The base of the triangle is the upper margin of the symphysis.

After the operation is finished the bladder-wall is closed by two rows of catgut sutures. One of these secures the mucosa, the other, the muscular coat and the overlying cellular tissue. The divided ends of the recti and pyramidales are brought together and the outer wound closed, save at the lower end, where a chinosol gauze drain is placed in the wound.

After-treatment.—Practically the same as after a vesicovaginal fistula repair. In addition the abdominal wound must be cared for.

When the tumor cannot be removed, it is sometimes advisable to remove as much as possible, the raw surface being cauterized. In such cases it may be necessary to establish a permanent fistula either by the vagina or by the abdominal wall.

Removal of the bladder has been carried out in cases of malignant disease, but the mortality is very high and the results not satisfactory, even when the patient survives. The ureters have been grafted into bowel, skin, urethra, or vagina in such cases.

Foreign Bodies in the Bladder.—Various articles may be introduced, *e. g.*, hairpins, buttons, etc.; they may ulcerate through the wall, *e. g.*, a pessary from the vagina; worms, feces, and other bodies from the bowel; portions of a fetus from an ectopic gestation sac; contents of abscesses and cysts. They tend to set up cystitis, and may work their way through the wall, attended by suppuration. They may become the nucleus of calculi.

Treatment.—They are to be removed according to the principles observed in the removal of stone. Complications require attention.

Rupture of the Bladder.—This may be caused sometimes by violent straining, made by a patient when the bladder is distended, or from some injury, *e. g.*, a kick in the abdomen. Generally, the rupture is intraperitoneal, though it may be extraperitoneal; sometimes both varieties are found in the same tear. Very rarely rupture may take place spontaneously, as a result of overdistention, *e. g.*, in retroversion of the gravid uterus and various weak conditions of the bladder-wall. Sometimes it may be due to ulceration or to sloughing following inflammation or pressure.

The most common site of rupture is the posterior wall. Urine is poured into the peritoneal cavity when the rupture is intraperitoneal. Peritonitis may or may not quickly follow, depending on the presence of micro-organisms. When the urine is extraperitoneal, it becomes extravasated.

In *diagnosis* it may be of service to inject a warm aseptic lotion into the bladder; if the viscus be all right, it enlarges, and the fluid can again be drawn off through the catheter.

Treatment.—The condition of shock which is present must be attended to. If the rupture be into the peritoneum, abdominal section should be carried out, the rupture sutured, and the bladder drained by the urethra for days. If it is necessary to wait for a time before this operation can be carried out, the bladder should be drained *per urethram* until abdominal section can be carried out. In extraperitoneal rupture it may be sufficient to carry out continuous drainage of the bladder by way of the urethra.

URETERS.

Anomalies.—There may be two ureters on one or both sides. The second ureter may extend from the kidney to the bladder, opening into the latter usually near the normal ureter, or it may open into the latter at some distance above the bladder; sometimes it may end blindly in the bladder-wall, and so may become distended.

The ureters of one side may cross in their course. Rarely, there may be more than two ureters on one side. In some cases in which only one ureter descends from each kidney both may open into the same side of the bladder. Sometimes a ureter may open into the urethra or vestibule; rarely, into the vagina or rectum. Sometimes a ureter may be congenitally absent.

In a considerable percentage of cases these anomalies are associated with other congenital malformations. Thus implantation of a ureter into the rectum may be associated with imperforate anus. There may be deficiency of the bladder, malformation of the uterus, vagina, etc. When the lower end of the ureter is impervious, the upper end may not communicate with the kidney, or

the latter may be atrophied or hydronephrotic. In many cases no surgical treatment is possible.

When the ureter opens into the urethra, vagina, or uterus, and no other serious malformation is a contraindication to surgical interference, an attempt should be made to graft the lower end into the bladder by the vaginal route. It may, however, be necessary to perform abdominal grafting.

Ureteritis.—The ureter is liable to the same inflammatory changes which are found in the bladder or pelvis of the kidney. Primary ureteritis is rare. In most cases the condition is secondary, being due to extension from the bladder, kidney, or surrounding tissues. In tuberculous ureteritis the tube may become much thickened and hardened, irregular ulceration occurring on the inner wall.

Thickening of the lower portion of the ureter may be detected through the anterior vaginal wall by digital examination; or on rectal exploration the part which is related to the broad ligament may be palpated.

Ureteritis is usually associated with pain on the affected side and with frequent and painful urination. Pus and often blood is found in the urine. Treatment is usually unsatisfactory. Kelly has advocated catheterization of the affected canal for the purpose of irrigating it with a weak antiseptic solution every two or three days. I have employed normal saline solution containing formalin (10 drops to a pint). This procedure may also be carried out when the renal pelvis is infected.

Obstruction of the Ureter.—This may result from pressure external to the ureter, *e. g.*, that caused by various tumors and exudates; from cicatricial tissue around the ureter; from thickening of the wall, *e. g.*, infiltrating carcinoma, tuberculosis; from cicatricial contraction following inflammation or ulceration in the wall; from bodies in the lumen, *e. g.*, calculus, fibrin-masses, débris from ulcerated areas; from twists of the ureter. The obstruction may be unilateral or bilateral, partial or complete. Dilation of the ureter and renal pelvis develops above the obstruction and may become marked (hydroureter, hydronephrosis) if the obstruction be prolonged. When infection is present, pus is found in the dilated portions (pyoureter, pyonephrosis).

In some cases the distention is continuous and permanent; in others it is intermittent, the accumulated fluid discharging into the bladder from time to time.

Stricture of the lower end of the ureter may sometimes be satisfactorily dilated by a series of catheters. It may be necessary to pass them daily for several weeks. Stricture of the upper portion may sometimes be successfully treated by exposing the affected portion and carrying out a plastic procedure for the purpose of establishing a patent canal. Fenger recommended making a longitudinal incision through the stricture and closing it horizontally.

Calculi in the Ureter.—It is rare to find calculi in the ureter. They form in the kidney and pass down. They tend to lodge chiefly at the junction with the renal pelvis, at the level of the pelvic brim, and near the bladder. When a stone lodges in the ureter, it tends to become elongated. Kelly has reported one five inches in length. Small calculi may pass into the bladder, usually with marked pain. Those which lodge in the canal cause urinary obstruction and dilation of the ureter and renal pelvis.

In diagnosing the condition careful exploration of the pelvis must be made through the vagina and rectum. In this way a calculus in the lower end of the

ureter may usually be palpated. In the upper part of the canal a stone may be detected by means of a skiagraph. This method is not, however, to be relied upon, especially when the calculus is below the level of the pelvic brim.

If a bougie or catheter be passed along the ureter (see p. 173), it is stopped by the stone.

If the instrument be tipped with wax, the latter may present irregularities caused by scraping against the calculus.

If the interior of the bladder be carefully examined, urine may be seen escaping from the normal ureter, but not from the obstructed one.

If a catheter be inserted in each ureter, the urine flows from the normal side, but none escapes from the other side if the obstruction is complete.

The passage of a stone along the ureter is usually accompanied with marked pain and general distress. The pulse and temperature are elevated. The urine may be bloody. When it obstructs the ureter, there are usually periodic attacks of pain and enlargement of the corresponding kidney. Sometimes a stone in the upper end of the ureter acts like a ball-valve. When infection exists, giving rise to pyonephrosis and pyoureter, fever is usually present, though it may be absent. Removal of a stone may sometimes be carried out through the distended bladder when it is situated close to the latter, a narrow forceps being used, and the ureteral orifice being distended with metal bougies if necessary. Pressure of a finger in the anterior fornix may aid in the extraction. When this method fails, an incision may be made through the anterior vaginal wall over the calculus. Before closing the opening with catgut sutures a bougie should be passed upward in the ureter to determine whether or not another calculus is present. When the stone is situated in the upper end of the ureter, an incision should be made in the lumbar region, sufficiently high to allow the kidney to be palpated. It should be carried downward and forward in front of the anterior-superior spine, as far as is necessary. A large extent of the ureter may thus be found without opening the peritoneal cavity. The stone is removed through a longitudinal incision in the ureter. The opening is then closed with catgut, but before doing so it is advisable to pass a bougie through the lower part of the ureter, to determine whether or not it is obstructed elsewhere. The upper part of the ureter and renal pelvis may also be palpated. Sometimes this procedure may be accompanied by removal of calculi from the kidney, or it may be necessary to drain the latter through the lumbar opening. When the kidney is much disorganized, it may be necessary to remove it.

When the stone is lodged at or below the pelvic brim, Kelly recommends removal through an incision in the semilunar line, the ureter being exposed extraperitoneally.

Prolapse of the Ureteral Mucosa.—This is a rare condition. Kelly states that it is commonest in female children, being usually congenital, and that it depends on stricture at the ureteral orifice causing accumulation of urine above. The latter escaping, forces down the mucosa.

Very rarely extensive ureteral prolapse may descend through the urethra.

GENITO-URINARY FISTULA.

The following fistula may be formed between the urinary and genital

passages: urethrovaginal, urethrovesicovaginal, vesicovaginal, vesicouterine, ureterovaginal, and uretero-uterine.

ETIOLOGY.

Malignant disease of the bladder, cervix, or vagina may establish the fistula. It may be brought about by ulceration resulting from an ill-fitting or a too long-retained vaginal pessary.

It may follow a phlegmonous vaginitis or a necrosis of the bladder-wall from any cause. It may result from the perforation of fetal bones which have worked their way into the bladder from a suppurating ectopic gestation-sac. In the same way a calculus or vesical foreign body may perforate the wall. In the great majority of cases, however, fistula can be attributed to labor. In connection with this process it may be brought about in two ways, namely, by direct rupture, associated with or without manual or instrumental interference on the part of the accoucheur; in most instances the fistula follows a sloughing of tissue produced by a long-continued pressure of the soft parts against the pubes by the fetal head.

PATHOLOGY.

The most frequent fistula is the vesicovaginal. It varies in size; in the most extreme case the whole vesicovaginal septum may be destroyed. Occasionally more than one opening is found. Some fistulas may only admit a probe; others a finger or two. At first the edges of the fistula are swollen. Later on, as cicatrization occurs, they become thin and hard. Contraction tends to take place in the opening. When the fistula is large, the mucosa of the bladder may bulge somewhat through.

The urethra, through disuse, contracts and may become greatly stenosed. The vagina may be contracted as a result of the injury which led to the fistula, and may present cicatricial bands. These may give rise to pockets, in which urine may collect and decompose, leading to calcareous deposit. The cicatrization may cause the vaginal wall to become closely adherent to the pelvic wall; this may sometimes considerably affect the urethra.

Cystitis is often present, and ureteritis is sometimes found; the ureter may be dilated if the cicatrization about the fistula interferes with the lower end. When the ureter is opened, it is usually secondary to a vesicovaginal fistula; the vesical wound may heal, leaving the opening into the ureter. Where there is an opening in or near the cervix, the irritation tends to keep up endometritis.

SYMPTOMS.

When the fistula is established, there is an involuntary flow of urine into the vagina. In connection with labor, if the cause be a tear, this immediately follows delivery; if due to pressure and sloughing, it may be delayed for several days (three to ten). The quantity of urine which escapes depends on the situation and size of the fistula. Where there is a ureteric opening, the bladder acts normally in connection with the normal ureter, but there is a constant dribbling as a result of the fistulous opening into the other.

If a vesicovaginal fistula be near the cervix, there is only a continuous flow

when the patient lies down; in the erect posture, that part of the bladder below the level of the opening collects a quantity of urine, and if the patient makes water frequently, there may be only occasional overflow through the fistula. If the latter be near the urethra, the patient may be much troubled only when standing or walking; when lying on her back, she may be able to hold considerable urine in the bladder. Sometimes the posterior vaginal wall may press against the fistula and help to retain a quantity of urine while the woman lies on her back; or, if the introitus vaginæ be small, there may be some retention within the vagina in the dorsal position, the urine escaping when the woman rises. When there is a urethrovaginal fistula, urine escapes into the vagina only during micturition.

As a result of the flow of urine in fistulous cases there is a urinous odor about the patient. The external genitals are tender; they may become excoriated and inflamed.

Amenorrhea and sterility are common. The general health may become greatly deteriorated.

DIAGNOSIS.

Large fistulas may be seen or felt on vaginal examination. A sound may be passed through the urethra into the vagina by way of the fistula. A small fistula may be very difficult to find, owing to its being hidden by cicatricial bands, to its high situation in the vagina or in the cervix, or to its being somewhat obliquely directed. In such a difficult case colored fluid, *e. g.*, milk and water (sterilized), or solution of potassium permanganate, should be injected into the bladder, and its escape should be watched for by way of the vagina, which is dilated with specula; the vagina should be thoroughly dried beforehand. Sometimes a piece of blotting-paper placed in the vagina may be used to catch the first drops of fluid, thus showing the site of the fistula.

If the fistula communicates with the cervix, it may be well to dilate the cervical canal before making the examination. If it communicates with the ureter only, injection of the bladder is not followed by any escape through the vagina. Sometimes the urine may be seen to escape from the ureteric opening in little jets.

In all cases in which the relationship of the ureters to the fistula is uncertain, careful exploration should be made through the Kelly speculum, the patient being placed in the elevated lithotomy posture, the bladder and vagina being distended with air.

TREATMENT.

For many years the operative methods employed for the closure of vesicovaginal fistula have been based upon the principles laid down by Marion Sims, *i. e.*, free paring of the edges of the fistula and coaptation of the raw surface by means of sutures. Sims was not the first to suggest this method. It is certain that it was recommended by Van Roonhuysen, of Holland, in the seventeenth century, and that Fatio, of Basel, and others employed it successfully in the eighteenth century.

In the early part of the present century Hayward, of Boston, pointed out the necessity of making a large raw surface, while Mettaner, of Virginia, advocated the use of the silver suture.

It is, however, to Marion Sims, and later to Simon, that we are mainly indebted for the elaboration of the operation and for the demonstration of its superiority over the other methods of treatment. They have, indeed, made universal the plastic operation as the only reliable means of treating fistulas. Yet, important as the results of their methods have been, there can be no doubt that better results may be obtained by the employment of certain modifications, both in regard to the manner of preparing the raw surfaces and of uniting them.

Sims and Simon recommended that the edges of the fistula should be denuded by the removal of a strip of tissue, extending from the vaginal to the

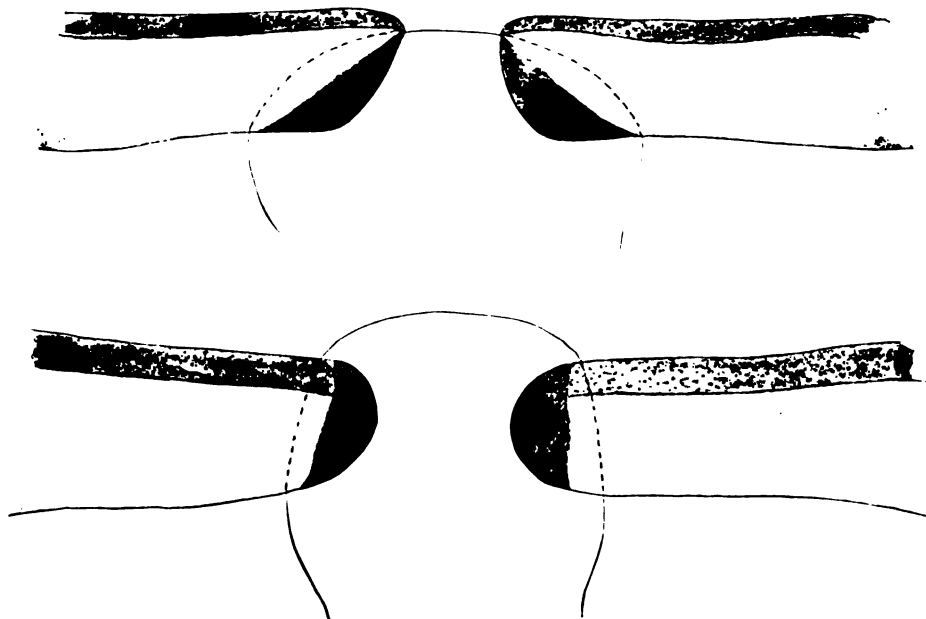


Fig. 344.—Diagrams illustrating Sims' (upper) and Simon's (lower) operation. The dark areas at the edge of the fistula represent the area of tissue removed. The sutures are shown in position.

vesical mucosa. The former pared the edges by a sloping incision, which did not divide the latter, but passed close to it. Simon made an incision less sloping, which did not specially avoid the vesical mucosa.

The improvements upon these methods which are to be recommended may be best considered in relation to the following varieties of fistula:

Vesicovaginal:

1. Very small.
2. Small or medium.
3. Large.
4. Very large.
 - (a) With lower edge not cicatrized close to pubes.
 - (b) With lower edge cicatrized close to pubes.

- Uterovesicovaginal.
 Uterovesical.
 Urethrovaginal.
 Ureterovaginal.
 Ureterocervical.
 Incurable.

Vesicovaginal Fistulas.

1. Very Small Fistulas, *i. e.*, those through which only a Probe or Sound may be Passed.—In these cases it is entirely unnecessary to employ the Sims or Simon method. The following plan is more easily carried out, and is thoroughly effective.

The patient is placed in the lithotomy position. The cervix uteri is drawn down, and the anterior vaginal wall exposed, as in the operation of anterior colporrhaphy.

A small oval flap of vaginal mucosa, $\frac{1}{2}$ inch or $\frac{3}{4}$ inch in diameter, is dissected from the anterior wall of the vagina, the fistula being in the center of the flap.

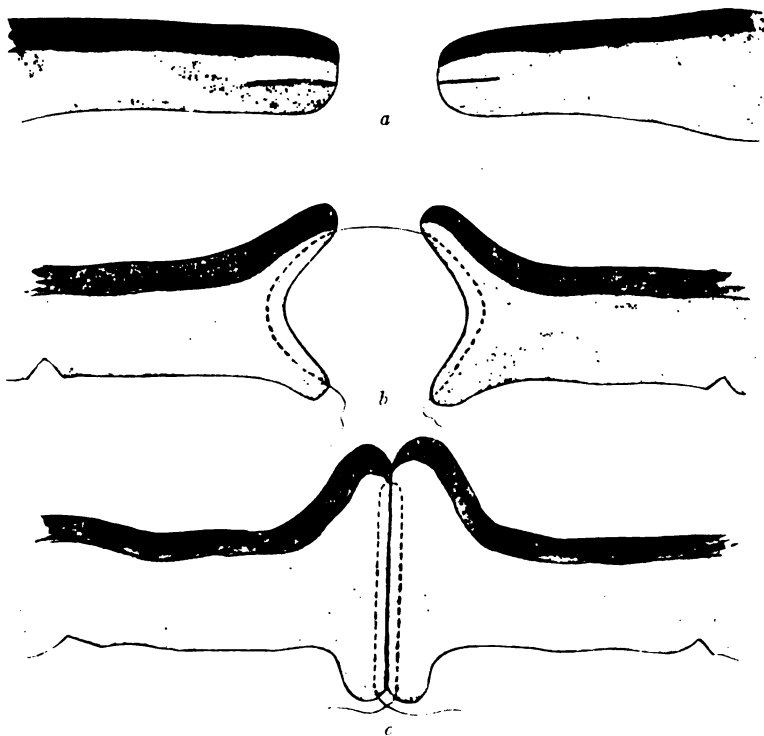


Fig. 345.—Walcher's operation: *a*, Fistula showing incision in edge; *b*, flaps separated and suture introduced; *c*, approximation of flaps.

Then, with a continuous catgut suture, applied in two or three stages, the raw surface is closed until only a longitudinal wound is left. In this way the fistula is covered by a thick mass of vaginal tissue.

2. Small or Medium-sized Fistula, in which there has been no Loss of Tissue, and whose Edges may be Approximated Fairly Closely.—Here it is not a good principle to remove a strip of tissue, as recommended by Sims and Simon. Every gynecologist has had experience of ill success by the use of their methods in these cases. Sometimes this is due to too great tension on the stitches. Sometimes, in fear of this danger, too small an amount of

tissue is removed, so that either nonunion or only partial union results. In successive attempts new raw surfaces are obtained only by renewed paring of the edges.

Such cases may require five, six, or more operations before permanent cure can be effected.

There can be no doubt that the method of denudation by removal of tissue is bad in these cases. Just as in the operation for perineal repair, this principle has been displaced by the flap operations of Lawson Tait and A. R. Simpson, so the Sims and Simon methods must be abandoned in the cases of vesicovaginal fistula now under consideration, for the flap-method introduced by Walcher, called by the French *autoplastie par dedoublement*.

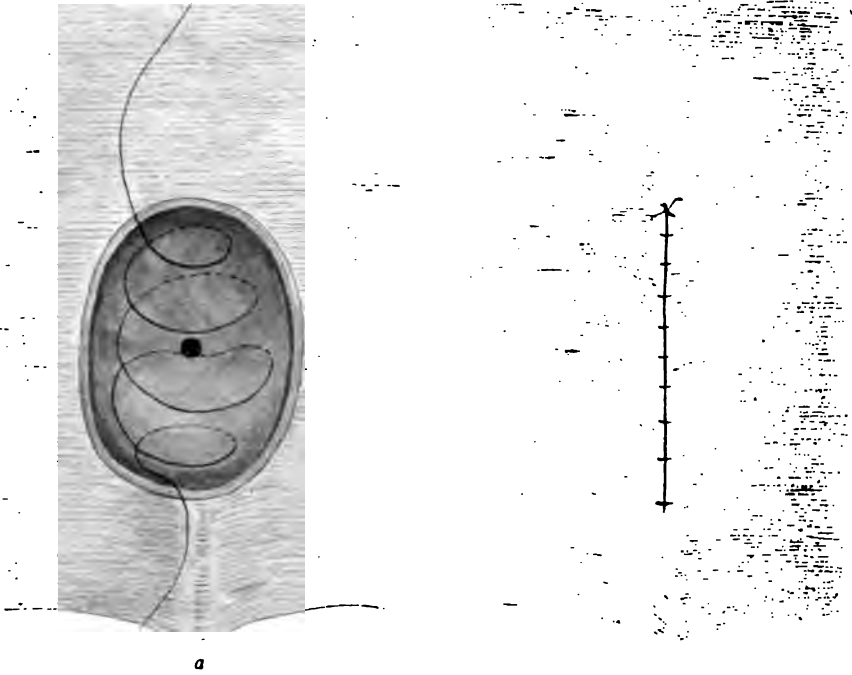


Fig. 346.—*a*, Raw surface made around a small fistula, and first stage of continuous suture; *b*, appearance of vaginal wall after closure of raw surface.

The operation should be performed as follows: The patient is placed in the lithotomy position, the anterior vaginal wall being exposed in the ordinary manner, and steadied with forceps applied near the fistula. The edge of the latter is then divided to the depth of $\frac{1}{4}$ inch or thereabouts, so that a vaginal and a vesical flap are formed. In the operation originally described by Walcher this was preceded by the removal of a thin strip of tissue from the extreme edge of the fistula. Winckel, however, in an important paper, published in 1891, in which he highly recommended this new method, showed that such a step was unnecessary. If the vesical flap be now pushed inward, and the vaginal flap pulled outward, it will be seen that a large raw surface exists

all around the fistula. Sutures are now applied. Walcher brought the vesical flaps together with catgut, and the vaginal flaps with silk. This is not necessary. Catgut alone may be employed, either by the continuous method or by separate sutures. In either case a deep series should be first passed, each one entering the raw tissue just inside the edge of the vaginal mucosa, and emerging close to the vesical mucosa. Afterward a superficial set should be used to close the edges of the vaginal mucosa.

In certain cases, if it be feared that the tension of the stitches is excessive, a simple means of relieving it may be adopted. Before the sutures are applied, a longitudinal incision $\frac{1}{2}$ inch or $\frac{3}{4}$ inch in length may be made through the mucosa of the anterior vaginal wall, somewhere near the outer border of the wall. As a result of this incision the vaginal flaps at the edge of the fistula

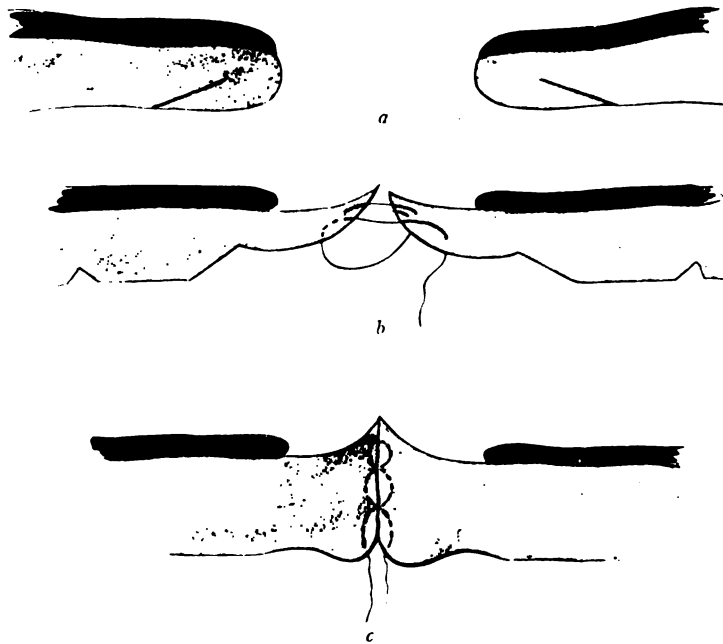


Fig. 347.—Martin-Ferguson operation: *a*, Oblique line of incision around fistula is shown; *b*, flap turned inward toward cavity of bladder; *c*, approximation of edges of flaps.

may be more readily approximated. This may be carried out on both sides if necessary.

After the closure of the fistula these lateral incisions, which have been made to gape, may be closed more or less thoroughly, the sutures being passed at right angles to the original incision.

3. **Large Fistula, in which there has been some Loss of Tissue.**—When the fistula is large and its edges cannot be approximated, owing to the loss of tissue which has occurred, it is useless to attempt its closure by the Sims method or even by Walcher's method.

In closing such fistulas I prefer the plan introduced by Mackenrodt for larger openings, described on p. 628. Before operating I examine the interior

of the bladder so as to determine the relation of the ureters to the fistula. If they are near the latter, I introduce catheters into them during the operation, in order that I may know their exact position and avoid injuring them or including them in a suture. This procedure should also be observed in dealing with all fistulas in the upper part of the vagina.

In such cases the following method has also been recommended by Martin, of Greifswald, by whom it was first employed in 1891. It has also been advocated by Ferguson. The operation is based upon Volkmann's procedure in *ectopia vesicæ*.

The patient is placed in the lithotomy position. The anterior wall is well exposed, and held with three or four pairs of forceps. An incision is made through the vaginal mucosa around the fistula, at a distance from its edges of little more than half the average transverse diameter of the opening. This flap is then dissected almost to the edge of the fistula, and is then turned inward so as to bridge across the opening.

It is thus evident that the vaginal surface of the flap has been turned toward the bladder, while a considerable raw surface looks toward the vagina, part of which belongs to the flap, part to the vaginal wall from which it was dissected. The edges of the flap are next brought together with catgut, and the whole raw surface is closed as much as possible with continuous catgut suture, just as in the operation of *colporrhaphy*.

If necessary, the lateral incisions, recommended in the last-described operation, may be made, in order to allow of the approximation of the edges of the wound with as little tension as possible.

If the raw surface be too large to allow of complete closure, the vaginal edges of the wound may be left unstitched, in order to heal by granulation.

By this method it is seen that the turned-in surface of the vaginal flap becomes the inner surface of the restored bladder-base.

If this method should not be completely successful after one operation, any fistulous tract remaining may be closed by a subsequent plastic procedure.

Stanmore Bishop has recommended the following procedure: A circular incision is made around the fistula, passing through the mucosa and part of the underlying tissue, so that a continuous flap can be raised and separated

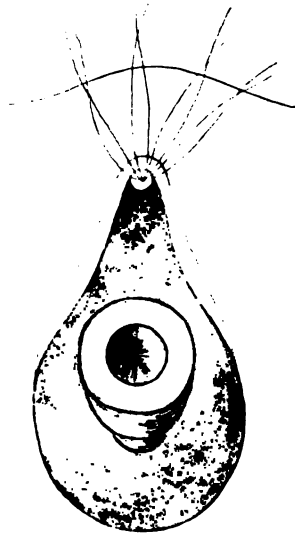


Fig. 348.—Stanmore Bishop's operation.

near to but not through the edge of the fistula. Through four equidistant points in the margin of the turned-in flap threads are passed, their outer free ends being knotted. Then a curved pair of forceps is passed through the urethra until its beak reaches the fistula, where it grasps the knotted ends of the four threads. These are thereby drawn through the bladder and out through the urethra. Gentle traction is made on the threads so as to invert the circular flap into the bladder. Just before this inversion, however, the edges of the flap are well approximated by means of a fine silk suture carried round the flap near its free margin. It is tightened and tied just after the process of inversion.

The urethral threads are then drawn upon, further inverting the flap, and the raw surfaces may be still more approximated by means of another circular suture. In this way the fistula is closed.

The urethral threads are then cut and withdrawn.

4. **Very Large Fistula.**—(a) *That in Which the Lower Edge of the Fistula has not been Cicatrized Close to the Pubic Bone.*—For such cases there can be no doubt as to the superiority of Mackenrodt's method. This is as follows: After fixing the cervix and anterior vaginal wall with forceps, a mesial longitudinal incision is made through the base of the bladder and the vaginal wall at the lower and upper parts of the fistula, which is thereby made continuous with the incisions. In this way the bladder is opened from cervix to urethra. The edge of the whole openings is then split, so that the bladder is thereby separated from the vagina for a short extent around the edge.

The bladder is also separated from the cervix for a considerable distance from the upper end of the incision. In this way it is made possible to bring the edges of the bladder-wall into apposition at the fistula. These are next united by a series of catgut sutures, extending from the cervix to the urethra. Afterward, the vaginal flaps of the fistulous margin are sutured. If there be any difficulty in carrying out the closure of the latter at the upper angle of the wound, the cervix may be drawn down and the vaginal flaps stitched to its anterior rawed surface.

(b) *That in which the Lower Edge of the Fistula is Cicatrized Close to the Pubes.*—For this the method advocated by Schauta is the best yet devised. A vertical incision is made through the labium majus on the side on which the cicatrization exists. It is carried deeply as far as the ramus. Then, with the finger and a spatula, the vaginal wall along the cicatrized edge of the fistula is separated from the bone. The wound is then stuffed with gauze, while the edges of the fistula, which are now easily brought together, are rawed and closed. Afterward the outer wound is closed.

Other Procedures.—E. C. Dudley* has closed a large fistula by making a semicircular raw surface on the vesical mucosa from one edge of the fistula to the other, stitching this denuded area to the rawed anterior part of the fistula. The bladder was thereafter reduced in size, but proved to be satisfactory.

Kelly† splits the margin of the large fistula posteriorly, separating the bladder-wall from the vagina. He then denudes its anterior margin on the vaginal surface and sutures to the latter the movable posterior bladder-wall.

*"Chicago Med. Jour. and Examiner," May, 1886.

† "Johns Hopkins Hosp. Bull.," February, 1896.

W. A. Freund* has made use of the uterus to close a large fistula, by incising the posterior fornix and drawing down the body into the vagina so as to stitch it to the edges of the fistula. An opening was made in the fundus so as to allow the menstrual blood to escape.

The following methods of treating these fistulas are not recommended. Trendelenburg† opened into the bladder extraperitoneally from above, cutting through the abdominal wall close to the upper margin of the symphysis. Wikhoff‡ tried the same plan, performing symphyseotomy in addition; the latter procedure gave no advantage, scarcely any separation of the bones being obtainable. Dittel§ performed a laparotomy, separating the cervix from the bladder and then closing the fistula.

After-treatment.—After the closure of a vesicovaginal fistula the bladder should be irrigated with hot normal saline solution in order to check oozing of blood in the bladder. A strip of antiseptic gauze is placed in the vagina, and a self-retaining catheter is placed in the bladder and connected with a bottle placed at the side of the bed. On the third day the vaginal gauze is removed and either a fresh piece inserted or daily antiseptic vaginal douches given. If the flow of urine is not free through the bladder, it is advisable to inject two or three ounces of normal saline solution through the catheter, in the hope of washing out any blood-clot that might cause an obstruction.

The catheter may be removed at the end of a week and the patient allowed to urinate at short intervals.

During the first week the patient should take only liquid diet. Urotropin should be administered for ten or twelve days (25 grains a day). If there is any tendency to alkalinity in the urine, acid sodium phosphate should be given in order to keep it acid, thereby increasing the efficacy of the urotropin and diminishing the risk of phosphatic deposits in the bladder and catheter.

Uterovesicovaginal Fistulas.

Those in which, at the apex of a tear in the cervix, there is an opening into the bladder. These may be closed simply by making a raw surface around the fistula and closing it with continuous catgut. To get a complete exposure of the opening it may be necessary to split the cervix at some point.

This method may not be successful if the fistula be difficult of access, and it does not leave the woman free from danger of reopening at another confinement. It is, therefore, better to employ the operation used in the treatment of uterovesical fistula next to be described.

Uterovesical Fistulas.

For these there can be no doubt that the following method is the best. A transverse incision is made in the anterior fornix and the bladder separated from the cervix as far up as is necessary to allow the fistulous tract to be well exposed.

* "Samml. klin. Vort.," N. F., 1895, No. 118.

† "Deutsche med. Wochenschr.," Leipzig, 1892, No. 23, S. 518.

‡ "Wien. klin. Wochenschr.," 1893, No. 11, S. 195.

§ "Wien. klin. Wochenschr.," 1893, No. 25, S. 448.

The vesical and cervical portions of the tract are then closed separately with catgut sutures. Afterward the wound in the anterior fornix is closed.

This method was first employed in England by Champneys, but it has also been used successfully abroad by Follet, Wölfler, Winternitz, and others.

Addenda.—All these operations should be preceded by the most thorough disinfection of the mucosa of bladder, vagina, and uterus, the strictest aseptic precautions being observed during the operation.

Catgut is sufficient for all sutures, formalin gut being used for buried sutures and chromicized gut for superficial ones. The most satisfactory needles are those which are full-curved and of small size.

After the operation it is probably best to drain the bladder *per urethram* by a self-retaining rubber catheter. The catheter must be passed carefully, so as not to tear the wound in the base of the bladder. After five or six days the patient may be allowed to make water at short intervals. A strip of antiseptic gauze should be placed in the vagina for three days. Then it should be removed and daily douches of formalin solution (25 drops to a pint) should be given. Urotropin may be given for a week or two by the mouth. Acid sodium phosphate may also be given in order to keep the urine acid, thereby enabling the urotropin to be more efficacious.

Urethrovaginal Fistulas.

These may be closed by either of the methods described on pp. 624, 625.

When a urethral as well as a vaginal fistula exists, the former should be closed first.

Ureterovaginal and Ureterocervical Fistulas.

These may be produced by tearing or necrosis in labor, but in most cases they result from division or ligation in the performance of hysterectomy. They may also result from the removal of swellings closely adherent to the broad ligament or developing in it. A few cases have been reported as resulting from the prolonged use of a pessary. Tuberculous ureteritis, ulceration, or malignant disease may also produce the lesion.

Ureterovaginal Fistula.

Different methods have been employed to effect closure. Pozzi recommends the following:

A transverse incision is made through the vaginal mucosa at the level of the fistula, extending outward on each side for about three-eighths of an inch. At each end an incision is made at right angles. Each flap is dissected back for about three-eighths of an inch. They are raised, and the fistula is seen in the center of the raw surface. The flaps are then drawn together, their raw surfaces being in apposition. Stitches are carefully applied.

Landau adopts another plan. If there be no large opening into the bladder in connection with the fistula, he makes one by the removal of an oval strip in the direction of the ureter. A fine elastic catheter is passed into the ureter, and carried into the bladder through the urethra. A raw surface is made around the fistula, and then closed with stitches, care being taken not to

pass them around the catheter. The catheter is left *in situ* for several days.

Dührssen's method is as follows: A director is introduced into the ureter through the fistulous opening. An oblique incision is then made in the wall of the vagina, passing through the fistula, and the two edges of the wound are dissected apart. The bladder is then slightly opened along the outer side of the fistula, and the septum between the ureter and the bladder divided. The ureteric mucosa is then sutured to that of the bladder, so that free communication is established between the ureter and bladder. The vesicovaginal opening is then closed.

Mackenrodt has carried out a grafting of the tissues around the fistulous orifice into the bladder as follows:

A sound is passed into the bladder through the urethra, so as to press down the vesicovaginal wall at the side of the fistula. The wall is then cut transversely at this level to an extent of 2 to 3 cm.

The incision is then carried through the vaginal wall around the fistula. The flap is dissected as far as the fistula, and is then turned up so that the vaginal surface becomes intravesical. The edges are then stitched to those of the vaginal incision and the raw surface closed with continuous catgut.

Second has employed a somewhat similar procedure.

E. C. Dudley's clamp method is suitable to some cases. The base of the bladder and anterior vaginal wall are divided mesially in their upper portion for the distance of an inch. The incision is then carried toward the ureteric fistula, so that the lower end of the ureter just above the fistula is opened. When the latter is distended with urine, a considerable amount of the fluid may escape. The vesical and vaginal mucosæ are then stitched together around the edge of the vesicovaginal fistula. A hemostatic forceps with slender jaws is introduced through the latter, one entering the ureter and the other the wall of the bladder at some distance from the edge of the vaginal opening. The handle is then clamped. In three or four days, owing to necrosis of the tissue in the jaws of the forceps, the latter drops out, leaving the ureter communicating freely with the bladder. At a later period the vesicovaginal fistula may be closed.

When these methods fail, a choice may be made of the following procedures:

1. Colpocleisis.
2. Grafting the ureter into the bladder by some method other than the vaginal.
3. Nephrectomy.

Colpocleisis is advisable only when women are past the child-bearing age. It should be performed only when the patient desires it, it being fully explained to her that sexual intercourse may afterward be imperfect or impossible. The closure of the vagina should be made at as high a level as possible. The author has carried out a high colpocleisis in two cases, with fairly satisfactory results as regards intercourse.

Removal of the kidney of the affected side should be carried out only as a last resort and only when the opposite kidney is perfectly healthy.

Abdominal Grafting of the Ureter into the Bladder.—This procedure should be recommended rather than nephrectomy.

Various methods have been tried. Of these, Witzel's operation is perhaps

the most satisfactory. A moderate quantity of normal saline solution is first injected into the bladder. The abdomen is opened by the ordinary median incision. A small incision is made in the peritoneum over the ureter, at or just below the brim, in order that the duct may be grasped and made tense. In the lower part of the broad ligament it is then exposed, doubly ligated, and divided. Through the first opening the part of the ureter below the brim is drawn up. A pair of long forceps is then passed behind the parietal peritoneum lateral to the bladder, on the affected side, above the pelvic brim, as high as the opening first made to expose the ureter. The latter is grasped and pulled down to the bladder. The two small incisions in the pelvic peritoneum, as well as the anterior peritoneal opening, are then closed. The rest of the operation is carried out extraperitoneally.

The bladder is drawn up laterally toward the iliac fossa so as to meet the ureter, and is fastened in this position with catgut sutures.

A catheter, previously introduced into the bladder through the urethra, is then gently pushed upward by an assistant so that the bladder-wall may be incised over it. A circular set of catgut sutures is then used to unite the ureteral to the vesical mucosa, another set of sutures being employed to approximate the rest of the divided bladder-wall to the ureter. A fold is then made in the bladder-wall parallel to the urethra and on each side of it, and the edges of these folds united so as to form a canal 4 cm. in length.

The abdominal incision is then closed, a glass drainage-tube being placed in the lower end so as to reach the site of the ureteral graft. The bladder is drained by a self-retaining catheter for several days.

Ureterocervical Fistula.

It is impossible to close this fistula by the vaginal route. Witzel's abdominal graft-method should be recommended. Unless this can be carried out, nephrectomy or colpocleisis must be advised.

In all cases in which nephrectomy is chosen, careful examination of the interior of the bladder should be carried out in order that the ureters be catheterized. Only in this way is it possible to determine accurately which ureter is sound. Unless this be done, the mistake may be made of extirpating the wrong kidney.

Colpocleisis.—Closure of the vagina as a means of treating urinary fistula is rarely necessary. It may be employed in the case of ureterocervical or ureterovaginal fistula where other procedures are not considered advisable or are not permitted; also in very extensive vesicovaginal fistulas which cannot be closed. The operation should be advised only after the menopause. If it is performed before this period, the menstrual blood escapes through the bladder and ascending infection of the uterus and tubes is apt to occur sooner or later.

(a) *High Colpocleisis.*—This operation is applicable to the cases in which a ureterocervical or ureterovaginal fistula exists.

It is necessary, first of all, to make a vesicovaginal fistula three-quarters of an inch in diameter below the cervix on the side of the fistula, care being taken to avoid the normal ureter; the vaginal and vesical mucosal edges are approximated by a series of fine catgut sutures. A circular incision is then made through the vaginal mucosa half an inch or more below the newly formed

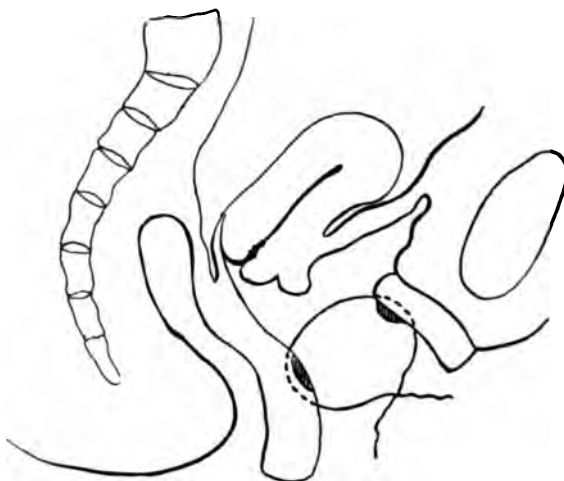
fistula; a circular flap of the vaginal mucosa is then dissected toward the fistula, but not reaching it. Its edges are then joined by catgut sutures. The extensive raw surface is then closed with continuous catgut, chromicized gut being used to approximate the lower vaginal edges.

(b) *Low Colpocleisis*.—This may be carried out in the case of a large incurable vesicovaginal fistula.

The raw surface is made in a manner similar to that just described, except that it is nearer the vulva. Ordinarily, very little of the vagina remains above the vulva after this procedure.

After-treatment.—The same as after-repair of a vesicovaginal fistula. If union is not complete after this operation, a small fistula may remain. This may be closed after several weeks by a simple plastic procedure.

It must always be remembered that after colpocleisis there is likely to be incomplete evacuation of the vesicovaginal cavity, and the residual urine in the vaginal portion may decompose, leading to the formation of calculi. Infection may also extend into the uterus or along the ureters to the kidneys.



Married women on whom this operation has been performed have been known to demand a restoration of their former condition in order that coitus might take place.

Fig. 349.—Colpocleisis. The diagram represents the application of sutures after raw areas are made.

DISTURBANCES OF MICTURITION.

Vesical Irritability.—This term is used to describe those cases in which there is a desire to urinate frequently. It is found in many different conditions. Thus, changes in the urine may cause it, such as marked acidity, excess of urates, phosphates, or oxalates. It occurs in various diseases of the bladder and urethra, new-growth, displacement, calculus, inflammation, ulceration, contracted bladder, urethral fissure, caruncle; it may be due merely to distention of the bladder with urine. It is found in early and in late pregnancy. Frequently, it results from the pressure of neighboring tumors, inflammatory or other swellings; from the traction of cicatricial bands or a displaced uterus. It may be caused reflexly from various conditions, *e. g.*, anal fissure or ulcer, piles, intestinal worms, irritating diseases of vagina or vulva following operations on pelvic structures.

Various renal disorders may be associated with vesical irritability, *e. g.*,

acute parenchymatous nephritis, chronic Bright's disease, some cases of cystic degeneration, calculus, pyelitis, tuberculosis. It occurs in various diseases of other parts, *e. g.*, diabetes, certain chronic spinal-cord lesions. It may be found in neurotic or hysteric women, in conditions of emotional excitement or other disturbed mental states.

In view of the multiplicity of causes of frequency of micturition it is evident that mistakes in diagnosis may easily be made unless cases are investigated with great thoroughness. There is no practice more common than the administration of drugs for a supposed irritating condition of urine or cystitis, when the disturbing factor is something entirely different, for example, the mechanic disturbance of a tumor, a retroflexed or prolapsed uterus.

Such mistakes may lead to serious consequences. Thus I have known a case of retroflexed gravid uterus in which overdilatation of the bladder was not recognized for several days, the dribbling of urine being considered as merely vesical irritability; extensive necrosis of the bladder-wall followed.

Retention of urine, complete or partial, is the state in which normal emptying of the bladder is impossible. It may occur in various conditions, *e. g.*, fevers, shock, injury to brain and spinal cord, general paralysis, various kinds of insanity, locomotor ataxia, myelitis of cord, hysteria, neighboring inflammations, *e. g.*, acute peritonitis and cellulitis, pressure on the neck of the bladder, *e. g.*, by tumors and retroversion of the gravid uterus, obstruction in the urethra, *e. g.*, polyp, blood-clot, calculus. Contraction of the sphincter may sometimes be caused by local conditions, *e. g.*, acute gonorrhea, operations in various pelvic conditions, *e. g.*, piles.

Incontinence of urine is characterized by continuous dribbling or by intermittent evacuations. This condition may be found in hysteria; in various injuries or diseases of the brain and spinal cord where the sphincter power of the neck of the bladder and urethra is lost, *e. g.*, in certain stages of locomotor ataxia, epilepsy; in advanced tuberculosis impairing the action; in vesicovaginal fistula; dilation of the urethra; intoxication; in various forms of stupor, *e. g.*, typhoid state; it may be due to strong stimuli acting on the bladder, urethra, or neighboring parts, *e. g.*, applications to neck of bladder or inner end of urethra; acute cystitis, calculus, submucous hemorrhages, caruncle, fissures, inflammation in tubes, ovaries, uterus, rectum; it may be found in early pregnancy.

In childhood there may be a true incontinence due to sphincter paralysis, hyperesthesia of the vesical mucosa, some localized disorder, or a nervous condition; but in the majority of cases the irritation is reflex, from such conditions as oxaluria, lithemia, worms in the bowel or vagina, polyps of rectum, eczema of vulva or perineum, and is, in most cases, found only at night. Once the habit is formed, it may remain long after the cause is removed.

It is of great importance to distinguish between incontinence of the above varieties and that which is due to the dribbling overflow of a distended bladder, such as may be found in locomotor ataxia and some other nervous diseases, in retroflexion of the gravid uterus, etc.

Neglect to diagnose the overdilatation of the bladder may result in serious damage to the wall of the viscus.

Pains in the Urinary Tract.—Pain in the kidneys is produced by various conditions. Sudden increase in tension, such as may be caused by acute con-

gestion or by interference with the free escape of urine through the ureter, may cause considerable distress.

A calculus which is loose in the pelvis usually causes pain, which may be very intense, because of the irritation to the mucous membrane accompanying inflammation or obstruction of the ureter. In some cases very large stones may be present in the kidney without any symptoms, or with only an occasional aching in the loins.

In malignant disease pain is not usually present until the advanced stages, though it may occur in the early condition if blood-clots block the renal pelvis or ureter, if there be inflammation or calculus formation, or if the tumor develop very rapidly.

In tuberculosis there may be no distress or merely a dull feeling in the loins, but where the pelvis of the kidney is considerably affected, there may be severe pain. Chronic hydronephrosis is usually accompanied only by a dull aching in the loins, which may be occasional or constant. If the condition is developed quickly, intense pain may be produced.

It is important to note that in some cases of kidney trouble the pain may be felt elsewhere. Thus stone in one organ may be associated with symptoms referable to the other kidney. The pain may be referred to the ureter, to the bladder, to distant parts, such as the shoulder, groin, thigh, leg. Pain may be caused in the region of the kidneys by organic nervous disease, *e. g.*, locomotor ataxia; in neurotic conditions, by myalgia in neighboring fasciæ and muscles; in pleurisy of the lower part of the chest.

Pain in the ureter may be caused by the passage along it of a stone, blood-clot, slough, or mass of débris; it may be due to ureteritis; it may result from various renal conditions, *e. g.*, calculi, especially those which tend to block the upper end of the ureter; it may occur when the canal is twisted or constricted.

Pain in the urethra may be due to inflammation, new-growth, caruncle, fissure; it may be referred from bladder, from extravescical, pelvic, or renal disorders.

Pain in the bladder is common in diseased conditions of the viscus, such as inflammation, ulceration, tuberculosis, new-growths (especially carcinoma), calculus. It has already been considered in the sections dealing with these diseases. It may be caused by the pressure or traction of tumors, uterine displacements, and by other pelvic lesions.

In some cases pain may be merely referred, *e. g.*, from the kidney. There may be diseases in the kidney, such as stone or tuberculosis, and the pain may be felt only in the bladder; or it may be referred from various diseased conditions in the pelvis. Sometimes pain is greatly exaggerated, owing to a neurotic condition of the woman. In some cases of neurosis pain may be referred to the bladder when no disorder can be detected in the entire urinary tract or elsewhere. Occasionally it may be due to organic disease of the nervous system. Vesical pains may be continuous, irregular, or felt only at micturition, and they vary considerably as regards their intensity.

Suppression of Urine.—This condition may be due to shock, to reflex causes, *e. g.*, injury to a kidney, sudden blocking of a ureter, injury to the lower urinary tract, operative procedures; to acute septic changes spreading to the kidneys; sometimes it is found in acute Bright's disease; sometimes in advanced inflammatory and cirrhotic forms of Bright's disease; rarely it is found

in hysteria. It may be caused by impaction of calculi in both ureters; by stricture of both ureters in advanced carcinoma in the pelvis; by obstruction of one ureter when the kidney of the opposite side is functionless; by new-growth of bladder implicating both ureters. Suppression may be complete, or a little urine may be passed. The condition must be distinguished from mere retention of urine in the bladder.

CHAPTER XX.

CERTAIN AFFECTIONS OF THE RECTUM.

Prolapse of the Rectum.—This condition may be partial when only a portion of the mucosa is prolapsed, or complete, when the whole wall is down (procidentia).

Etiology.—In women prolapse is most common in those who have borne several children or who are in a weakened state. Stretching of the anus in labor and loosening of the perirectal tissues undoubtedly favor its development. In some cases probably an abnormally long mesorectum is a predisposing factor. Prolonged or severe straining in urinating or defecating exercises a bad influence. It may thus follow continued diarrhea. Sometimes downward descent of the small intestines may help to produce the prolapse. Occasionally the condition may be caused by the dragging of new-growths or of piles.

Signs and Symptoms.—In *partial prolapse* the red projecting mucosa is evident, the sulci between the folds radiating from the lumen. After defecation the mass may usually be replaced, but in old-standing cases this may be difficult. In marked cases, also, prolapse may occur at times other than defecation. There may be a mucopurulent discharge, sometimes blood-stained. This condition must be distinguished from prolapse of hemorrhoids.

In *procidentia* the conditions vary. When the prolapsed portion forms a mass external to the anus, the sulci between the mucosal folds are mainly parallel to the margin of the anus. It is congested and often bleeds. In very bad cases there is more or less incontinence of feces and diarrhea, owing to loss of power in the sphincter and to diminution in their reaction to stimuli. Sometimes swellings several inches in diameter may be produced. The peritoneum may descend external to the anus and may contain intestine, whose coils may be felt. Sloughing and ulceration of the prolapsed mass may occur and rupture of the latter may sometimes take place. Peritonitis may thus develop after the latter accident.

In another variety of *procidentia* where the upper part of the rectum descends into the lower, but does not pass through the anus, there are usually constipation, tenesmus, straining, and difficulty in defecation, a feeling of fullness and burning in the bowel, and a mucopurulent or blood-stained discharge.

Treatment.—The treatment of prolapse in the adult is often very unsatisfactory. In cases complicated with polyp or piles removal of these may be followed by improvement.

In slight cases it is sufficient to see that the bowels are regulated carefully, and that they are moved in the dorsal or lateral posture; it is best to do this at bedtime, so that rest follows the act. The anus may be washed with cold water, alum, or oak-bark lotion. In some cases more active measures are necessary.

Where the prolapse is not great or of long standing, it may be sufficient, after reduction of the prolapse, to dilate the anus with a speculum and to cau-

terize the mucosa by a dull red point in a series of vertical lines extending from 3 to 4 inches above the anus, down to the junction of the anal mucosa and skin. The sphincter should be slightly divided on each side. The patient is then kept in bed for a week or two, the bed-pan being used for two weeks or more when the bowels are moved, enemata of warm water being given to help defecation.

In cases in which simple measures fail, the following procedure, recommended by Neves, may be tried. The patient is placed in the lithotomy position and the relaxed mucosa pulled downward. The latter is divided circularly near the junction with the skin, and turned down like a cuff. This is then removed by another incision near the anus. The end of the divided mucosa is then stitched to the skin near the anus with silk or silkworm-gut. J. B. Roberts has recommended the following plan:

A mesial incision is made into the skin just in front of the coccyx. With a finger the posterior connections of the bowel are separated. Then, with a bistoury, a triangular piece of tissue is removed, including skin, cellular tissue, and sphincter; the base of the triangle is the margin of the anus. Next, a triangular piece of the posterior bowel-wall is removed, the apex being about 3 inches from the anus. The edges of the rectal incision are then tied with cat-gut sutures on the mucosal surface. The outer wound is then closed, save near the tip of the coccyx, where a drain is inserted external to the rectum.

In cases of procidentia of the upper part of the rectum into the lower it is advisable to perform abdominal section for the purpose of drawing up the rectum and stitching the mesentery to the parietes above the pelvic brim, in order that adhesions may form, and so prevent descent of the bowel.

Fissures of the Anus.—This is an ulcer or crack in the mucosa at or internal to the anal opening, in relation to one or other sphincter. It may be caused by straining at stool in constipation or diarrhea; by the presence of polyps; as a result of narrowing of the anus due to a congenital peculiarity or to hypertrophy of the sphincter. It is frequently found in syphilitics. Fissures vary in size, shape, and appearance. Some are so small that they may be overlooked on careless examination; others may be of considerable size. Fissures are usually single, but they may be multiple, especially in syphilitics. If they are infected, the surface may be covered with slough and there is more or less infiltration around them. The symptoms vary somewhat. Usually there is marked pain during defecation. This is most severe when the fissures are near the anus. In many cases the pain continues after the bowels have moved, and may be most intense at this time. In some cases blood may also be passed at stool. Pains may be reflected to other parts, *e. g.*, back, groin, legs. There may also be vesical tenesmus or retention of urine. The introduction of the finger into the rectum causes severe distress.

Treatment.—In some cases cure may be effected by simple measures. The patient should rest as much as possible for a few days. The bowels should be carefully regulated, but not purged. After each action a soothing ointment containing cocain or opium may be applied. In syphilitic cases appropriate specific drugs should be administered. When such measures fail, the fissure and the subjacent external sphincter should be divided, the knife being held at right angles to the latter. If there is much spasm of the internal sphincter, it should be dilated. In this way the muscle is set at rest and the wound is al-

lowed to heal. If any polyp is found, it should be removed. The patient should be kept in bed until healing is complete, and great care should afterward be observed in dieting and in attention to bowel action. Many surgeons recommend forcible dilation of the sphincter under an anesthetic, so as to paralyze it for a few days. This method, while advisable in old and very weak persons, and in cases complicated with removal of a polyp, is not more satisfactory than incision. If it be employed in the treatment of fissures situated over the internal sphincter, it is almost certain to result in failure.

Ulceration of the Rectum.—Apart from the irritable or painful ulcer just described, the rectum may be affected above the level of the internal sphincter. Allingham describes the various forms as tuberculous, dysenteric, syphilitic, and traumatic. Ulceration may also be caused by malignant disease. These may result in more or less destruction of the bowel-wall, which may lead to stricture. Sometimes perforation into the vagina or peritoneal cavity may occur. Frequently, localized cellulitis or peritonitis may develop, the uterus and adnexa being secondarily affected. It is probable that a considerable number of pelvic inflammations in women originate in this manner. The symptoms vary somewhat. There is usually diarrhea, especially in the morning, which may be accompanied by tenesmus and a burning feeling, mucus, mucopus, or "coffee-grounds" fluid being passed. There may be alternate diarrhea and constipation. When the peritoneum or other parts become infected, there may be considerable pain.

Treatment.—In all cases rest in the recumbent position is advisable. The diet should be liquid and nourishing, milk, plasmon, plasmon-cocoa being considerably used. I have found that daily irrigation of the rectum with a solution of formalin (8 to 12 drops to a pint of normal salt solution) is valuable in promoting healing. In some cases neither this nor any other lotion can be endured by the patient. The silver salts are highly recommended by many. When there is much distress, bismuth, opium, belladonna, or subacetate of lead may be used in ointment or other form. Allingham recommends the following mixture:

Iodoform.....	gr. xx
Cocain.....	gr. xvij
Lanolin.....	5j.

In dysenteric cases the internal administration of ipecacuanha is indicated, and in syphilis, mercury or iodid of potash.

Abscess in Ano.—Abscess near the anus may result from various causes: local exposure to cold and dampness; external trauma, *e. g.*, bruise; internal injury to the bowel mucosa due to straining at stool, constipation, irritation of solid bodies in the feces, parasites; local manifestation of general infection. Exhausted conditions, tuberculosis, and piles may be regarded as predisposing factors. In most cases the abscess begins in the subcutaneous tissue external to the anus; in other cases in the ischiorectal fossa or close to the bowel-wall; sometimes as an ulcerated condition of the mucosa. Rarely it may develop in the upper perirectal tissue and gradually extend downward.

Acute abscesses may develop very quickly, chronic cases often very slowly. If left to themselves, they open spontaneously, giving rise to discharging sinuses or fistulas.

Treatment in the early stages should always be incision and drainage.

Fistula in Ano.—This condition is almost always due to a previous abscess. It may be complete, when it extends from skin to mucosa, or incomplete, when there is only one opening; of the latter, there are two varieties, in one of which the opening is in the mucosa—blind internal fistula; in the other of which it is in the skin—blind external fistula.

In cases of complete fistula as well as of blind internal fistula the inner opening is usually between the external and internal sphincters. Various complexities are found in fistulas. Thus one may have several branches. Sometimes there may be more than one external opening; rarely more than one internal opening. Sometimes the internal and external openings may be in opposite sides of the bowel—"horseshoe" fistula. The symptoms vary somewhat. Flatus and liquid feces usually escape through a complete fistula, though in some cases this does not happen, owing to the smallness of the internal opening. Pain usually follows the passage of fecal matter. If the fistula becomes obstructed, fresh infection may give rise to another abscess.

Treatment.—A small blind external fistula may heal if it is allowed to drain freely and the cavity cleansed regularly. A perforated "collar-button" drain may be used to keep the skin-opening patent, or the edge of the latter may be incised.

When the fistula is complete, operation should be carried out under anesthesia, the bowels having been thoroughly opened beforehand. A grooved director is passed along the fistula, being guided into the bowel by a finger passed through the anus, which should be somewhat dilated. If the inner opening cannot be found, the director may be pushed through the bowel-wall at the upper part of the fistulous tract. The tissues below the director should then be divided with a knife, so that the fistulous tract is well exposed. Any sinus running above or beyond the internal opening should be laid open. Lateral extensions should also be opened. The wound is then packed with antiseptic gauze. A firm pad is placed over the perineum and held in position by a T-bandage.

When a blind internal fistula exists, a probe or director curved like a hook should be passed into it, the point being brought down toward the skin. The tissues are then divided over it, so that the fistula is exposed.

When there is a horseshoe fistula, the sphincter should not be divided in more than one place, in order to avoid the danger of after-incontinence of feces. The muscle must in all cases be divided at right angles.

In two days after operation the gauze is removed, and the wound irrigated with a mild antiseptic lotion. Fresh gauze is again lightly introduced, so as to irritate the patient as little as possible.

Rectovaginal Fistula.—This condition may result from traumatism in labor. It may be due to necrosis of tissue associated with carcinoma or syphilis of the rectum. It may result from the burrowing of an abscess. Rarely it may follow ulceration caused by long retention of a pessary in the vagina.

The condition is usually distressing to the patient, flatus and frequently feces escaping through the fistula. The adjacent parts of the vagina and vulva may become tender and excoriated.

Treatment.—When the lesion is due to malignant disease, it is curable. In other cases operative treatment may be employed, care being taken to build

up the system beforehand and to give specific remedies if there be a syphilitic taint. For several days before operation antiseptic fomentations should be applied to the vulva and the vagina should be irrigated daily. The bowels should be thoroughly cleansed. In carrying out surgical treatment the same principles are to be observed as have been described in connection with the repair of vesicovaginal fistula. Denudation should be carried out on the vaginal side by means of the flap-splitting method.

In order that the risk of contamination from the bowel may be reduced to a minimum, a glass tube inclosed in rubber may be kept in the anus for several days so as to allow gas and fecal matter to escape. Some operators, however, prefer to stretch the sphincter previous to operating, in order that it may be functionless for several days.

Inflammation of the Rectal Mucosa.—This may be either acute or chronic. It may occur as the result of venereal infection, or may be associated with new-growths, piles, prolapse, or inflammation outside the bowel. In elderly women it is sometimes found apart from these conditions. The symptoms vary somewhat. There is more or less desire to go to stool frequently, excessive mucus, sometimes blood-stained, being passed. The patient complains of rectal discomfort, fulness, or tenesmus. The bladder may also be irritable, or there may be difficulty in urinating. In acute cases the conditions resemble dysentery, except that there is no abdominal pain or tenderness.

Treatment.—The patient should be quiet and the diet should be simple. The rectum should be irrigated twice daily with normal salt solution, a small quantity of formalin being added (5 min. to 1 pint). Hot hip-baths relieve severe distress. Morphin may, however, be necessary. Purging should be avoided.

Stricture of the Rectum.—Stricture may follow any marked form of ulceration. In such cases abscesses are very apt to form external to the gut, giving rise to fistulas.

Stricture may also occur where no ulceration has been present. Thus injury, inflammatory thickening, or tumors external to the mucosa may cause it. Rarely a stricture may be congenital in nature. In most cases the condition is found in the lower rectum, but it may be higher.

Symptoms.—These vary somewhat. Most characteristic are straining at stool and difficulty in evacuating the bowel. Frequently, diarrhea and constipation alternate. When the stricture is near the anus, the stools may be thin and long, but this peculiarity may be present when no stricture exists, *e. g.*, in spasm of the sphincter. More commonly the stool escapes in a number of small fragments. Pain in the rectum is rare, but it may be referred to the perineum, coccyx, thighs, back, etc.

Treatment.—When ulceration exists, appropriate treatment must be carried out. The stricture may be cautiously dilated with flexible solid-rubber bougies. These should be passed two or three times a week. Sometimes superficial division of the stricture is necessary previous to the passage of bougies. In very bad cases, especially if there be ulceration and fistulas, the stricture and the entire wall of the gut below its level should be divided posteriorly as deep as the coccyx. The wound may be packed with gauze and allowed to close from above downward.

When this operation is not successful, it may be necessary to perform

colotomy. This is especially advisable when there is marked rectal tuberculosis. When the stricture is due to a swelling arising independent of the rectum, attention must be directed to its removal.

Pruritus Ani.—This condition is not so common in women as in men. It may result from intemperate eating and drinking or from the use of certain articles of diet. Diabetic urine or excessive discharges from the genital tract or bowel may cause it. It may be due to local skin diseases, pediculosis, parasites in the rectum, piles, fissures, or diseases of the genitalia. Continued scratching may lead to eczema, cracks, thickening of the skin, and may thus aggravate the condition. In some cases in which no definite cause may be ascertained it is possible that there may be a fibrosis of terminal nerves and end-organs similar to that which I have found in pruritus vulvæ.

Treatment.—The alimentary functions should be strictly regulated and systematic exercise enjoined. Local irritating causes must be removed as far as possible. The various soothing lotions and ointments used in the treatment of pruritus vulvæ may be employed. Temporary benefit is often obtained from the local application of a solution of silver nitrate in spiritus ætheris nitrosi (15 gr. to the ounce). A solution of menthol (8 to 15 gr.) in almond oil (3 dr.) is also satisfactory.

x-ray applications may sometimes cause complete disappearance of the disease.

Hemorrhoids; New-growths of the Rectum.—For an account of these conditions special works on diseases of the rectum should be consulted.

Coccydynia.—This is a tender or painful condition in the region of the coccyx, and may be considered here.

It is most pronounced in nervous women, no discoverable lesion being present. It may, however, be due to a fall, a blow, or injury in labor, leading to stretching of ligaments, dislocation, or inflammation. It may be referred pain from diseases of ovaries, uterus, anus, etc. In some cases there may be a condition of neuritis.

The pain varies. It may be worse after any kind of strain or exertion, *e. g.*, riding, driving, defecation, or rising from a sitting posture. Pressure increases it and may cause the pain to radiate widely. The general health may suffer.

Treatment.—The neurotic complication must be attended to. Cocain hypodermatically may be necessary; sometimes morphin. These drugs, however, must be used with great discretion.

In some cases pelvic inflammation or uterine or ovarian displacement is associated with the pain complained of. In other cases the affection seems to be neuralgic in nature, and not associated with physical change. In others again the pain is distinctly associated with lesions of the coccyx or ligaments attached to it.

In the first class of cases the existing pelvic condition should be treated. In the second class, faradic electricity should be employed, one electrode being placed on the coccyx and the other on the sacrum. Two to eight applications may suffice. The strength of current should be increased from time to time.

In the third class of cases extirpation of the coccyx should be carried out. An incision is made through the skin, the bone is separated from the soft tissues attached to it, and is then divided transversely by a chain saw or by bone forceps.

CHAPTER XXI.

ECTOPIC GESTATION.

DEFINITION.

By an ectopic gestation is meant one that develops outside of the uterine cavity. By many this term is considered as synonymous with extra-uterine. The latter, however, cannot be strictly held to include interstitial gestations, and is, therefore, abandoned by the author for the former expression, which was first employed by Robert Barnes in 1873.

ETIOLOGY.

For a long time it has been held that an ovum fertilized at the fimbriated end of the tube might develop anywhere on the tubal mucosa, normal or abnormal, if it were prevented from passing into the uterus by various mechanic forces—*i. e.*, tumors of the tube-wall or of neighboring structures pressing upon it, polyps in the lumen, constriction of the tube by adhesions, displacement by diverticula of the tube-lumen, interference with the peristaltic action of the tube as the result of thickness or adhesions, and destruction of the cilia in the tube by inflammation. Various other causes have been assigned, such as traumatism, *e. g.*, a fall, fright, mental excitement, etc.

In 1895 the author pointed out that these views were largely speculative. He showed that while frequently these mechanic factors might be associated with ectopic pregnancy, there was no proof that they were the ultimate factors in its causation. He demonstrated the existence of the decidual reaction in the tubal mucosa in all cases of tubal pregnancy, and advanced the view that the fertilized ovum could develop only on tissue capable of undergoing a genetic reaction. Normally in the human female this reaction, occurring as the result of fertilization, takes place in the mucosa of the uterus. Its occasional occurrence in other portions derived from the Müllerian tract, *i. e.*, Fallopian tubes—is to be regarded as a reversion in these tissues to an earlier mammalian type, either in structure or in reaction tendency.

The fertilized ovum, coming in contact with any portion of the Müllerian tract capable of establishing with it the relationship that is necessary to its development, may become attached and grow just as readily as if it were lodged in the uterine cavity. Since the great majority of ectopic gestations occur within the tube-lumen, it is very easy to understand why all mechanic conditions that interfere with the transit of the ovum through the tube might play a part in determining the site of its attachment. It is, however, an unjustifiable assumption to hold that the ovum, if simply obstructed in its downward movement, may develop in a tubal mucosa that is perfectly normal or altered by inflammation.

When the phylogeny of the Müllerian tract is borne in mind, it is not surprising that there should occur occasionally in the human subject a con-

dition of tubal mucosa in which characteristics normally limited to the uterine mucosa may be found. The evolution of the single uterus of the human female from the bicornute condition of the lower animals, in which more than one ovum normally develops, has been accompanied by a differentiation in structure and function, the upper portion of the Müllerian tract on either side—viz., the Fallopian tube—acting as an egg-carrier; the lower portion—viz., the uterus—serving as the egg-holder. The author strongly holds that there is no proof whatever that ectopic pregnancy begins its development on any other than Müllerian tissue. Primary development on the peritoneum has never yet been established.

In the rare condition of ovarian pregnancy, as will be pointed out later (p. 655), it is not at all unlikely that the presence of Müllerian remains in the ovary may determine the site of pregnancy in this organ.

CLASSIFICATION.

Almost all ectopic pregnancies begin their development in contact with some portion of the tubal mucosa, and may be classed as follows:

A. **Tubal.**—I. *Ampullar*, in which the gestation begins in the ampulla or middle portion of the tube. This includes the majority of cases.

II. *Interstitial*, in which the ovum develops in that portion of the tube situated in the wall of the uterus.

III. *Infundibular*, in which the gestation develops in the outer end of the tube-lumen or among the fimbriæ.

B. **Anomalous.**—Under this heading may be included all varieties which do not begin to develop actually within the tube-lumen. Among these may be placed gestations that develop in accessory fimbriated extremities or in tubal diverticula. Here also should be included those which develop on the ovarian fimbria or in detached portions of Müllerian tissue—*e. g.*, those attached to or embedded in the ovary. In the latter category should be placed some recently described cases of ovarian pregnancy.

C. **Cornual pregnancy**, in which the ovum develops in the undeveloped horn of a bicornute uterus, though not strictly speaking ectopic, is usually considered in this connection.

VARIETIES STUDIED IN DETAIL.

A. **Tubal.**—I. *Ampullar.*—1. *Persistent.*—Very few cases have been recorded where pregnancy has reached an advanced stage without rupture. As the tube enlarges it may occupy various positions in the pelvis; in late stages it may sometimes be found entirely above the brim, though it generally partially occupies the pelvic cavity. It may be somewhat pedunculated, though its mobility is usually early impaired by the formation of adhesions to surrounding structures.

2. *Cases which Rupture into the Broad Ligament.*—(a) *Persistent.*—Some cases after rupture continue their development. These have been variously denominated as “extraperitoneal,” “tuboligamentous,” “subperitoneopelvic,” and “broad-ligament.” When the gestation develops upward in the abdominal cavity without opening into the peritoneal cavity, the term “subperitoneo-abdominal” has been used to describe it. The rupture takes place usually between the eighth and fourteenth weeks; sometimes at an earlier or later

period. It is due to a gradual thinning and stretching of the lower part of the tube-wall within the layers of the broad ligament. The ovum may rapidly or gradually extend through the opening, the broad ligament gradually becoming distended by it. The gestation then tends to increase in all directions and may descend to a very low level in the pelvic floor, displacing the uterus, bladder, and rectum, and stripping the peritoneum from these structures and from the pelvic wall.

In some cases the uterus may be pushed against one side of the pelvis, or it may be pushed markedly toward the front when the gestation burrows under the peritoneum behind it. As the extension develops upward into the abdomen the peritoneum is stripped from the abdominal parietes and from portions of the viscera. The position of the placenta varies in different cases. When it is situated mainly lowermost in the tube, it may gradually extend between the layers of the broad ligament, being found mainly within the pelvis, even if



Fig. 350.—Ruptured tubal pregnancy. Near the outer end of the tube is a subperitoneal cyst:
A, Ovum with attached blood-clot as it was removed from the pouch of Douglas.

the gestation should reach an advanced stage. When it is mainly uppermost in the tube, it may be greatly elevated upward into the abdomen behind the peritoneum, and through the adhesions that form on the outer surface of the tube it may lie in close relationship to the parietes or to the viscera.

(b) *Rupture of the Extraperitoneal Variety into the Peritoneal Cavity.*—After the escape of a tubal pregnancy into the broad ligament there may be a secondary rupture into the peritoneal cavity. This may take place immediately or at various periods afterward. The site of rupture is most frequently the upper posterior part of the sac-wall.

(c) *Termination of the Gestation.*—Instead of continuing its development after rupture into the broad ligament, the gestation may come to an end in several ways. Blood-extravasation may take place to such an extent that the placenta is detached or greatly torn, a hematoma being produced, in which are scattered the various portions of the ovum. The blood may spread in several directions from the original site of the hemorrhage—in some cases the mass

increasing greatly in size owing to successive outpourings of blood. In course of time the hematoma may gradually become absorbed.

In some cases infection occurs, suppuration taking place in the broad ligament, forming a pelvic abscess that may burrow in various directions, and may escape through the bowels, bladder, vagina, abdominal wall, perineum, buttock, or groin; in the majority of cases opening takes place into the bowel, especially the rectum or sigmoid flexure. The discharge may continue for a short or long time; in some cases it may last for many years. Infection in these cases almost always arises from the bowel, being due to the stripping upward of the peritoneum and to the close relationship that is established between the gestation-sac and the wall of the bowel.

In some cases mummification of the fetus may occur, though sometimes it may be transformed into adipocere or a lithopedion.

3. *Cases which Rupture into the Peritoneal Cavity.*—(a) *Tubo-peritoneal Gestation.*—In this form the fetus escapes in its membranes into the peritoneal cavity, the placenta remaining in the tube, the pregnancy continuing to progress. This variety was first definitely established by the author, in 1892, who described in detail a case in which pregnancy had advanced to term; the fetus lay in the amniotic sac, which was attached to the peritoneum behind the stomach, transverse colon, and great omentum.

(b) *Termination of Gestation.*—In the majority of cases in which rupture occurs into the peritoneal cavity the life of the fetus comes to an end, and the mother's life is endangered by the outpouring of blood that occurs.

As regards the most favorable period for rupture, statistics show that it exists during the second, third, and fourth months of gestation. During the first month it is, indeed, rare.

Henning reports 95 cases, as follows:

Rupture occurred in the	1st month in	5 cases.
" " " 2d "	" "	22 "
" " " 3d "	" "	18 "
" " " 4th "	" "	23 "
" " " 5th "	" "	8 "
" " " 6th "	" "	1 case.
" " " 7th "	" "	1 "
" " " 8th "	" "	6 cases.
" " " 9th "	" "	1 case.
" " " 10th "	" "	0 cases.
Beyond the 10th "	" "	1 case.

In Von Schrenk's 141 collected cases, rupture took place—

In the 1st month in	13 cases.
" 2d "	67 "
" 3d "	28 "
" 4th "	12 "

In Schauta's 87 cases—

In the 1st month in	15 cases.
" 2d "	29 "
" 3d "	23 "
" 4th "	10 "

In Mackenrodt's 38 cases—

In the 1st month in	6 cases
" 2d "	23 "
" 3d "	5 "
" 4th "	4 "

It is important to consider the conditions which exist in this abnormal state and which favor the occurrence of hemorrhage, as well as those which cause variations in the extent and severity of the blood-loss. From examinations of gestation-sacs at different stages of pregnancy it is evident that the muscular part of the wall does not respond to the demand of the developing ovum, as is the case when pregnancy occurs within the normal fruit-holder, the uterus. In the latter organ a progressive hyperplasia of the musculature takes place, along with a marked degree of hypertrophy.

In the pregnant Fallopian tube similar changes occur, but they are chiefly marked during the first two or three months. After this period they may be found, though not in any marked degree, considerable variations being found in different instances. After the early weeks of gestation the muscle-bundles tend to become broken up, the component parts being gradually displaced in various directions. In the late months of pregnancy one may examine considerable portions of the wall of the gestation-sac without finding any muscle whatever, owing to the great separation of the fibers which has taken place. Generally, also, as gestation advances atrophy of the fibers takes place in many parts. After the early weeks, the most important structure in the wall is connective tissue. The thickness of the wall varies in different parts. Marked thickening is usually due either to inflammatory deposit on the outer surface or to hemorrhage in the substance of the wall. Extreme thinness at any point is probably due to a variety of factors, *e. g.*, early separation of muscular bundles, stretching of an originally thin portion under the pressure of the growing ovum, sudden hemorrhage taking place within the wall. According to some observers it is stated that the wall is thickened opposite the area of the placental attachment. The author cannot corroborate this statement. It may appear to be thickened in section, but this is simply due to the number of large blood-vessels in the wall at this part or to hemorrhages in it.

With the gestation-sac in such a condition it is not difficult to understand why it may rupture under various states, *e. g.*, sudden increase in blood-pressure in the pelvic vessels, sudden alterations in intra-abdominal pressure, such as are produced by blows, falls, strains, etc., distention of the tube from hemorrhage within it. The nature and extent of the rupture vary greatly in different cases. It may be of considerable size or extremely small, and may be rounded, linear, or irregular in appearance. It may be found in the placental or non-placental part of the wall or involving both. When the former is involved, the bleeding is generally most severe and dangerous. The whole ovum, or part of it only, may pass through the rent into the peritoneal cavity. According to Orthmann, complete passage occurs in the majority of instances. Sometimes the opening may be plugged tightly or loosely by the fetus or placenta, so that the hemorrhage is wholly or partly checked. With such a number of conditions it is easy to understand why so many different clinical pictures are presented in cases of hematocele.

In a large number of cases the outpouring of blood is so sudden or so extensive that the woman's life is greatly endangered. Thus, Parry found that, out of 113 cases, 39 died within ten hours, 81 within twenty-four hours, and 98 within forty-eight hours. In some cases only a small hemorrhage occurs at the time of rupture, followed at other periods by successive fresh losses. The intervals

of cessation are due to various causes, *e. g.*, contraction and retraction of the torn vessel or of the part of the wall surrounding the rupture, or plugging of the opening by fetus, placenta, or membranes. It is important to note that a succession of small losses may prove very serious to the woman.

Sometimes a considerable accumulation of blood takes place within the tube before the wall is completely ruptured into the peritoneal cavity. This accumulation may be found in the cavity, between the wall and placenta or membranes, in the lumen of the tube external to the ovum, or in the substance of the wall itself.

In other cases, after rupture, the blood may escape into the peritoneal cavity very slowly, or only in limited quantities, owing to the obstruction to its movement resulting from inflammatory deposits on the gestation-sac or from adhesions to neighboring viscera. Sanger has drawn special attention to the limitation and localization of intraperitoneal blood effusions as a result of a previous formation of peritonitic adhesions.

The period of pregnancy is also probably an important factor in determining the blood-loss. In the early weeks there is more probability, in the majority of cases, of a quick arrest of hemorrhage than at a more advanced period, and, consequently, of less immediate risk to the mother; this is due to the fact that the vessels in the wall of the gestation-sac are not greatly enlarged and that the musculature is not too much altered to retract on the torn vessels so as to check the bleeding. Yet it must be remembered that, sometimes, rupture, in very early cases of tubal gestation, may lead to a rapidly fatal issue. This is much more liable to occur after the placenta is well formed, owing to the great development of blood-vessels in that part of the sac-wall to which the placenta is attached.

In the early months, also, the mass which escapes into the peritoneal cavity is more likely to be absorbed quickly than in advanced pregnancy, because in early cases the absorptive power of the peritoneum is less apt to be interfered with by inflammatory changes than where gestation has lasted for some time. Moreover, the early ovum may be easily absorbed by the peritoneum, whereas, when the placenta is well formed and the fetus of some size, absorption is more difficult. In the latter case it may be partly absorbed, or may, with or without partial absorption, become encapsulated by peritonitis. This may sometimes lead to a fatal issue; suppuration may occur or the fetus may become shriveled or changed into a mass of adipocere or into a lithopedion.

There seems, indeed, little doubt that the risks to the mother from rupture during the first weeks of pregnancy are less than in the succeeding months.

Another factor of importance is the condition of the fimbriated end of the Fallopian tube. In early tubal gestation this is patent in a far greater percentage of cases than in more advanced cases. In a small number of early cases it may be closed by perisalpingitis or by adhesion to neighboring structures, but this is more usually found after pregnancy has advanced. The size of the opening varies; it may be naturally large or small, but it is also affected by the situation of the gestation. The nearer the ovum to the outer end of the tube, the more it is apt to be dilated. When inflammatory changes occur in the peritoneal covering, the tube may be completely or only partially closed. In view of these various conditions it is evident that, in considering the fimbriated end of the tube as a way by which intratubal blood may escape into the peri-

toneal cavity, the possibility of several variations in the amount and rapidity of the blood-stream must be admitted.

The origin of hematocele in an escape of blood through the outer end of the tube is more frequent than is supposed. In Cullingworth's 20 cases, it is very interesting to note, the hemorrhage occurred in this manner; in the greater number the outpouring had taken place slowly, the blood becoming clotted and encapsuled so as to form a localized mass. According to this author, it is very rare that the blood escapes so rapidly as to become widely diffused throughout the peritoneal cavity. He believes—and I am in agreement with him—that the majority of the favorable cases of hematocele are those in which the escape of blood takes place through the open end of the tube in very early tubal pregnancy.

That this form of hemorrhage should be frequent is not surprising when we consider the relationship of the early ovum in tubal gestation. In my study

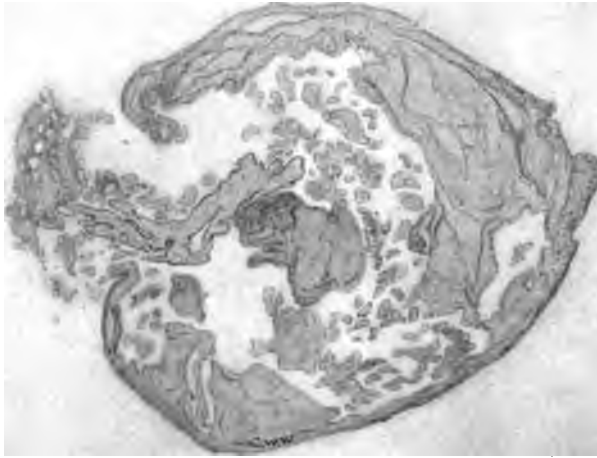


Fig. 351.—Transverse section of ruptured pregnant tube. The gestation was about two months old. There was extensive escape of blood into the peritoneal cavity.

of the developmental changes in this condition I have pointed out the circumstances especially favorable to the occurrence of intratubal hemorrhage. These are as follows: The decidua reflexa is usually extremely thin and may not be completely formed. It is prone to undergo very early degenerative changes of the nature of coagulation necrosis. The vessels tend to rupture easily; indeed, I have never examined a specimen in which blood was not effused in its substance. Very important, however, is the relation of the reflexa to the placenta. In normal uterine pregnancy, in the great majority of cases, the chorion laeve, attached to the reflexa, gradually degenerates and disappears, the chorion frondosum only, which is attached to the decidua serotina, developing to form the permanent placenta. It is rare that the chorion laeve develops in a portion of its extent, forming the so-called reflexal placenta, continuous with the serotinal placenta. In tubal gestation it is, on the other hand, very common to

find the permanent placenta developing partly on the reflexa. (The reason of this is evident when one bears in mind the very small area of the tube-wall which can give rise to a serotina as compared with the condition existing in uterine pregnancy.)

The development of large vessels, to supply the intervillous circulation, in a reflexa which is very thin and degenerated, is probably, therefore, an important cause of the very frequent hemorrhages which occur within the Fallopian tube in early pregnancy. The reflexa may rupture so that blood may escape either on its inner surface, coming into relationship with fetal structures, or on its outer surface, forming a mass in the tube-lumen.

4. *The Gestation may be Destroyed in the Tube.*—(a) *By the Occurrence of the so-called Tubal Abortion.*—This consists in the detachment of the ovum, complete or partial, from the tube-wall, accompanied by hemorrhage, the mass gradually escaping through the fimbriated end of the tube into the peritoneal cavity. Sometimes only blood escapes, the destroyed ovum remaining in the tube; in some cases part of it may escape with the blood.

Abortion is most likely to occur during the first two months of gestation while the outer end of the tube is patent. It can also take place if the end be closed with recently formed weak adhesions.

In 32 cases reported by Mackenrodt, abortion occurred during the first month in 8 cases, during the second month in 19 cases, during the third month in 4 cases, and during the fourth month in 1 case.

In 29 cases reported by Orthmann it occurred: in the first month in 13 cases, the second month in 10 cases, the third month in 4 cases, and the fourth month in 2 cases.

In most cases, according to Orthmann, the ovum is completely expelled. This is most apt to occur when gestation is in the outer part of the tube, though it is possible for the ovum to be moved some distance by the contractions of the muscular part of the tube-wall, the contents passing in the direction of least resistance.

Lawson Tait has objected to the use of the term "tubal abortion" on the ground that practitioners may be led to consider the condition as of no greater seriousness than an ordinary "uterine abortion." Such a mistake on the part of a physician could be due only to abject ignorance. Tubal abortion leads to various results as far as the woman is concerned, one of the most important being the fatal issue which occurs in some cases. A large amount of blood may be quickly poured into the peritoneal cavity, endangering her life, and death may be immediate, or delayed for only a few hours. In other cases a large hematocoele may be formed, the woman remaining in a critical condition for some days, and then undergoing a long period of recovery. Frequently only a localized mass may form.

As regards the ovum, various changes take place; if gestation be early, it may easily be absorbed when escape takes place into the peritoneal cavity. It is believed by some writers that a very early ovum may sometimes become attached to the peritoneum and continue to develop, but such an occurrence has not been definitely demonstrated. After the early months, when the placenta is a well-formed structure, partial or total escape of it into the peritoneal cavity with or without the fetus, is probably always fatal, from the amount of blood poured out, unless immediate operation be carried out. In some cases,

PLATE X.



Fig. 1.—Interstitial ectopic pregnancy dissected from the uterus. The tube and ovary are attached.



Fig. 2.—Interstitial ectopic pregnancy. The mass represented in the preceding figure is divided. The placenta forms a complete ring in the gestation sac. The embryo lies in the amniotic cavity.

as Orthmann has pointed out, very little blood may be found with the ovum after it has passed into the peritoneal cavity, though blood-clot may be found in the tube itself. Such a combination, according to this author, is never found when the escape of the ovum takes place through a rupture in the tube-wall; in such a case blood is always found in a peritoneal cavity. While Orthmann's observations are quite correct, it is probable that, in the majority of cases in which no blood was noticed by him in the peritoneal cavity along with the ovum, there had been some escape of blood followed by rapid absorption through the peritoneum.

(b) *By the Formation of a Mole.*—In certain cases the ovum does not pass into the peritoneal cavity as a fresh abortion, but as an altered mass known as a "mole," formed by extravasations of blood into the membranes and placenta, the fetus being killed and more or less destroyed. The older the mole, the less likely is its passage through the end of the tube to be accompanied with marked loss of blood.

In comparing the effects of the escape of the ovum through the fimbriated end with those following its passage through the ruptured wall it is found that, in the latter condition, the mother runs greater risks, for there is more likelihood of free intraperitoneal hemorrhage taking place. In nineteen cases reported by Cullingworth in which escape occurred through the end of the tube a free effusion of blood took place only in one instance; in the great majority of cases a localized pelvic hematocele was formed. In nine cases in which rupture of the tube-wall occurred, free intraperitoneal hemorrhage took place in seven.

(c) *By the Formation of a Hematosalpinx.*—The tube may be distended with blood, the ovum being more or less broken up and diffused throughout it.

(d) *By Rupture into the Wall of the Tube.*—Berkeley and Bonney have recently described rupture of the gestation-sac among the muscular fibers of the tube-wall, forming a swelling which may resemble closely a hematosalpinx. Secondary rupture into the peritoneal cavity, broad ligament, or tube-lumen may take place.

(e) *By Suppuration.*—The contents of the tube may sometimes become infected, leading to the formation of a pyosalpinx.

(f) *In Cases in which Pregnancy is Considerably Advanced.*—Mummification or transformation into adipocere or a lithopedion may result.

II. Interstitial.—It is rare that an ovum develops in that portion of the tube-wall that is situated in the uterine wall. In early specimens the whole uterus appears to be enlarged, though irregularly. The gestation grows internal to the round ligament on the side to which it belongs (as does a cornual pregnancy). As the sac enlarges it pushes the uterine cavity toward the opposite side; it may also extend outward between the layers of the broad ligament, or upward toward the abdomen. Sometimes the gestation may extend into the uterine cavity. As development continues some part of the uterine musculature surrounding the gestation becomes very thin.

Rarely may an interstitial pregnancy continue to full time; rupture usually occurs. When this is intraperitoneal, the result is usually fatal owing to hemorrhage. Rupture between the layers of the broad ligament is rare. Sometimes it may take place into the uterine cavity, or into both peritoneal and uterine cavities. Very rarely the fetus may die in advanced gestation, the ovum remaining *in situ*.

III. Infundibular.—An ovum may develop in the outer end of the Fallopian tube, though not frequently. Cases have been described as “tubo-ovarian” and “tubo-abdominal.” Owing to the mobility of the outer end of the tube, such gestations are likely to be found in various positions, and adhesions may form between the fimbriæ and the ovary, broad ligament, parietes, bowel, bladder, etc. The gestation-sac may easily rupture and the ovum may pass into the peritoneal cavity or elsewhere. Sometimes it may extend into an ovarian sac of peritoneum behind the broad ligament; sometimes into a corpus luteum cavity or other cyst of the ovary.

B. Anomalous Varieties.—Under this heading may be included some very rare forms of gestation whose development is not yet well ascertained. It has been shown that an ovum may become attached to and grow in an accessory tube, an accessory fimbriated extremity, and in a tubal diverticulum. It may also develop on the ovarian fimbria near the tube or near the ovary. In this category must be placed those cases described as “ovarian pregnancy.”



Fig. 352.—Ovarian gestation (described by author in “Transactions of the Amer. Gyn. Soc.,” vol. xxix, 1904).

Ovarian Gestation.—It is now incontestable that an ovum may be found entirely within the substance of the ovary. Yet this has been positively demonstrated only in recent years. Though for a long period the condition has been described, there is little doubt that most of the supposed cases have been wrongly reported.

In studying a specimen of supposed ovarian gestation, it must be remembered that several conditions may closely simulate it. These must be excluded before a positive diagnosis of ovarian gestation can be made. In the first place, reference should be made to *hematoma ovarii*, which has by some been considered as due to blood extravasation associated with the destruction of an ovarian pregnancy. It is scarcely necessary to state that such an explanation would be established only by the discovery of an embryo or of chorionic tissue.

Pregnancy in an accessory tube may easily be mistaken for an ovarian gestation. If the ovary of the same side becomes closely adherent to the pregnant tube and adhesions be extensive, a mistake may easily be made, especially

when a normal tube is found independent of the gestation-sac. In such a condition also, if the ovary be very small or absent, and the gestation-sac lay behind the normal tube, it might be easily mistaken for an ovarian swelling. In these cases the nonpregnant end of the accessory tube may become much thinned, so as to resemble a ligament or may even become divided.

A similar error may be made when pregnancy takes place in an accessory fimbriated extremity, or in a diverticulum of the tube. It may easily be made in the case of a gestation which begins on the ovarian fimbria. The ovary may become such an intimate part of the wall of the gestation-sac that it may easily be regarded as the primary seat of implantation of the growing ovum. The Fallopian tube, being empty, is not likely to be regarded as having furnished it.

In a similar manner a pregnancy growing at any part of the fimbriated end of the tube may so involve the ovary that the latter organ may be regarded as the original seat of the pregnancy, the outer end of the tube being considered as adherent to it. One interesting variety is that in which the outer end of the tube communicates with an ovarian sac, on the posterior surface of the broad ligament, containing the ovary. As the gestation gradually extends into this sac, the ovary may become flattened and blended with surrounding structures, so that its identity is lost.

A tubal gestation which early escapes into the broad ligament and continues to grow may form a swelling in the posterior part of the pelvis with which the ovary may become so intimately attached that it cannot be recognized as a distinct structure by the naked eye. If, in such a condition, the Fallopian tube can be easily traced for a considerable distance on the anterior surface of the sac, the diagnosis of ovarian gestation may easily be made. I have studied one such case in which the greatly thinned and stretched ovary could be detected by microscopic examination over an area of about two square inches, forming a considerable portion of the posterior wall of the gestation-sac. Moreover, a length of about four inches of the Fallopian tube could be traced as a distinct ridge on the upper anterior surface of the sac, and it was only by the study of serial sections that the place and extent of the ruptured area in the tube could be determined.

Such cases are most apt to be misleading when the unaffected part of the tube becomes elongated, by the stretching resulting from increase in size of the gestation-sac, and also when the fimbriated extremity is free.

Of the authentic specimens reported, the most complete descriptions are those published by Van Tussenbroek, of Amsterdam, Thompson, of Portland, Me., and the author.

The first-mentioned was demonstrated at the International Congress of Gynecologists in Amsterdam, 1899. It was obtained from Professor Kouwer, who had removed it from a woman by abdominal section. The gestation-sac was described as a mass larger than a walnut, forming a projection on the ovary; at one point it had ruptured, causing severe hemorrhage. There was an embryo, 12 mm. in length. The wall of the gestation-sac was, to a large extent, composed of a corpus luteum.

Thompson's specimen, exhibited before the American Gynecological Society in 1902, consisted of an ovary somewhat larger than normal, with a swelling as large as a horse-chestnut projecting from it. In the latter there was an ovum, the fetus measuring 1.2 cm. in length. The chorion was well developed,

but no amnion was found. The specimen described by the author was sent to him by Dr. E. Evans, of La Crosse, Wis. It was exhibited before the American Gynecological Society in 1904. The ovarian mass was irregularly rounded and measured about 8 cm. in diameter, the wall being intact. Near the middle was an amniotic cavity measuring 2.2 by 1.5 cm., external to which was chorionic tissue extensively destroyed by blood-extravasation. The wall of the gestation-sac was formed by the stretched and thinned ovarian tissue. The embryo had been destroyed and absorbed. Many of the villi were well developed; others were more or less degenerated. There was no trace of corpus luteum in relation to the outer part of the ovum, so that the latter was probably situated in a ripe follicle.

Those who describe follicular development of ovarian gestation usually assume that the ovum is fertilized *in situ* in the follicle. While this is possible, it has not been proved, even though Stratz has demonstrated the entrance of spermatozoa into a ruptured follicle in the ovary of *Sorex*. Until we possess specimens representing earlier stages of pregnancy we shall be ignorant of the original relationships of the ovum.

In some of those described as primarily follicular it may be that embedding of the ovum occurred external to a follicle and that afterward extension into the latter took place.

From what we know of the marked phagocytic properties of the early epiblastic covering of the ovum, whereby rapid embedding within the uterine mucosa is brought about, it is not at all impossible that a similar process may sometimes occur on a flattened area or in a depression on the surface of the ovary. It has certainly been demonstrated in connection with the ovarian fimbria. The method of the early embedding of the ovum in ovarian pregnancy is certainly the feature of greatest scientific interest in connection with the whole subject.

For some years the author has held that, on phylogenetic grounds, there is a strong reason in favor of believing that the fertilized ovum in the human female can only *begin* its development in tissue derived from the Müllerian tract. At the present time there are doubtless many who think that the recent demonstrations of ovarian gestation necessitate a modification of this view. Such a conclusion must be considered as hasty and ill-considered.

We know that a fertilized ovum may be embedded on a very small portion of a fimbria or on a detached portion of the Fallopian tube attached to the broad ligament. If it can be established that Müllerian tissue may occasionally be found in the ovary, it is reasonable to suppose that embedding of an ovum may take place in this tissue. The occasional blending of Müllerian and ovarian tissue has been abundantly proved, both by macroscopic and microscopic demonstration. Take, for instance, the relationships of the ovarian fimbria. In some cases its outer end may not reach the ovary; sometimes it may just touch it; occasionally its tip may be embedded in the ovary; frequently a considerable extent of the fimbria may be against the ovary or be adherent to it; in some cases there may be a break in its continuity, so that a small outer portion may lie close to the ovary detached from the main part. Marchand has directed attention to the early close relationship between the tubal epithelium and that covering the surface of the ovary, and has pointed out that they are one and the same surface. He believes that in some cases the line of demar-

PLATE XI.



Section of author's specimen of ovarian pregnancy. The wall of the gestation sac, the amniotic cavity, and the intervening extravasated blood containing chorionic tissue are seen.

cation, instead of being at the end of the ovarian fimbria, might reach over to the lateral portion of the ovary, and that from it processes might extend into the cortex of the ovary. The observations of de Sinety and Melassez in 1878 seemed to establish the correctness of such a view. Other studies, especially those of Whitridge Williams, leave no doubt as to the occasional extension of Müllerian tissue into the ovary.

In this connection attention may be directed to the observations of Schmorl and others in regard to the occasional occurrence of small localized areas of decidua-like cells in the ovary in cases of uterine pregnancy. The author has recently examined ten specimens in his museum and has found these changes in four ovaries. In each instance the areas were situated in the cortex at or near the surface, sometimes projecting slightly from the latter, sometimes extending for a considerable distance into the cortex. The cells in these areas present the closest resemblance to the uterine decidua in normal pregnancy, the cells showing similar variations in size and shape. The line of demarcation from the surrounding ovarian stroma is always well marked, giving the impression that the two tissues are distinct. Usually these areas contain dilated blood-vessels, which are not found in the neighboring unchanged ovarian stroma. Such areas are not found in ovaries removed from nonpregnant women. They are not peripheral sections of the theca interna of ripening Graafian follicles or of the corpus luteum, which is a derivative of the latter. The cells of the latter may undoubtedly closely simulate decidual tissue, both in their well-formed and in their degenerated condition, but the special peculiarity which distinguishes them and their relationships to the follicle usually suffice to establish their identity.

These cortical localizations of decidua-like cells in the ovary of pregnancy certainly suggest some special characteristic which makes the cells capable of undergoing the same genetic reaction which is ordinarily found in the uterine and tubal mucous membranes when pregnancy develops in relation to these tissues. It is not unlikely that these areas represent detached portions of Müllerian tissue which have become attached to the surface of the ovary. Occasionally, in the substance of such an area, a gland-like space lined with cubic or columnar epithelium may be found. The latter may, of course, be only a derivative of the surface germinal epithelium, but it may represent included Müllerian epithelium.

It is possible that the special genetic action in these areas may sometimes determine the embedding and growth of a fertilized ovum in the ovary, and if the opinion that these areas are Müllerian in origin be correct, it is not unlikely that all cases of pregnancy in ovarian tissue may still serve to support the dictum which has been expressed, viz., that the fertilized ovum in the human female begins its development in Müllerian tissue. While the proof of this is impossible, all *a priori* evidence is in its favor. Those who attempt to overthrow the hypothesis certainly undertake a heavy task in trying to establish an exception to the uniformity of performance of one of the most highly specialized functions in the human body.

It may be true that no definite decidual layer is found in relationship to the villi in the specimens demonstrated by Van Tussenbroek, Thompson, and the author. Though Van Tussenbroek, in her first description, mentioned a decidual layer, she afterward stated that this was an error, the cells being in

reality lutein cells of the corpus luteum. Her final account is doubtless in the main correct, but she cannot deny the possibility that some of the large cells were decidual. However, admitting that no decidual layer is found in specimens as advanced as those mentioned, we do not know that they were not present in a much earlier period when the ovum was very much smaller. One of the small decidual areas above described would very soon disappear as a result of the outward pressure of the expanding ovum, as well as of its phagocytic powers, if there were no more tissue capable of undergoing the change, and it is quite evident that the ovarian stroma proper does not tend to take on decidual characters.

Though no definite layer of decidua is found in my specimen, I have little doubt that the scattered groups of large cells found in the ovarian stroma nearest the ovum are decidual in character.

Even in tubal pregnancy, where decidual changes are always present in the early stages, there may be a marked disappearance as pregnancy advances, the production of cells being evidently much poorer than in the uterine mucosa in normal pregnancy, though in the latter there is a considerable range of variations.

For several years the author has held the belief that decidual transformation is peculiar to the Müllerian tract. The presence of occasional areas of decidua-like cells in the ovary in pregnancy has been mentioned as an exception. From what has already been stated it remains to be proved that these areas are not Müllerian in origin. Small localized decidual nodes have also been found in the broad ligaments. These may be derived from detached portions of Müllerian tissue which are quite common, especially in the upper portions of the broad ligaments. Similar areas have also been found under the peritoneum of the pregnant uterus, but this cannot be considered as at all remarkable, however exceptional it may be, since there is no doubt as to the Müllerian nature of the uterus. Decidual transformation may occasionally be found in the connective tissue between muscle-bundles in the middle of the wall.

Similar areas have also been described under the peritoneum of the pouch of Douglas, and it is not at all impossible that these may be detached portions of Müllerian tissue.

Primary Abdominal Gestation.—For a long period the belief in this variety of ectopic pregnancy has been wide-spread, but in recent years many leading authorities have refused to consider it as a possibility. Cases which have been described have been those in which the gestation was considerably advanced, the topography of the pelvic structures having been so altered by displacement, adhesions, and hemorrhages as to make it impossible to determine relationships accurately.

During the last two centuries the various classifications of ectopic gestations have been made mainly by ordinary postmortem dissection or by examination during operations. In recent years the fallacies associated with the employment of these methods have been well demonstrated by the use of the microscope and by the examination of the body in sections after freezing.

The value of sectional study in the determination of topographic relationships in ectopic gestation has been shown chiefly by Berry Hart and the author, especially in advanced cases, where the displacement of structures, peritoneal adhesions, and hemorrhages render it impossible to determine the nature of the

gestation-sac, either by examination at the time of an operation or by ordinary dissectional study. It is necessary, first of all, to study the body with the parts undisturbed, by means of frozen sections, afterward employing the microscope and dissection.

It was by following this plan that Hart and the author demonstrated the true nature of cases of advanced ectopic gestation, which had always been described as primary intra-abdominal. Hart's specimen proved to be one in which the gestation was entirely extraperitoneal, having begun in the tube, extended into the broad ligament, and afterward developed upward into the abdomen under the peritoneum.

In my case the gestation had begun in the tube, and the latter had burst so as to allow the unruptured amnion containing the fetus to escape into the peritoneal cavity, the gestation continuing to full time, the amniotic sac becoming attached to the viscera. The placenta remained in the tube. In each of these cases the relations of the peritoneum had become so altered by adhesions that until frozen sections were made the pregnancy was believed to be a primary abdominal one.

Recently, several cases have been published as genuine, one of which, described by Gutierrez, in *Revista Ibero-Americana de Ciencias medicas*, March, 1904, has attracted considerable attention.

This case was one of a multipara aged thirty-four. In April and May, 1902, there were no menstrual periods, and in June she aborted. In July she menstruated, and thereafter there were several months of amenorrhea, during which normal pregnancy was believed to be present. In April, 1903, eclampsia developed, uterine contractions being felt, and fetal movements, which previously had been active, ceasing. The patient recovered and afterward the breasts and the abdominal swelling diminished in size. Menstruation occurred in May, and each month after. In July Gutierrez found a round swelling as large as an eight-months pregnancy, smooth, elastic, and very slightly movable. In November, 1903, an abdominal incision was made. The tumor was partly covered by thickened omentum and adherent to the anterior abdominal wall. Many other adhesions were present. There was a sort of pedicle attaching the lower part of the tumor to the right side of the pelvis. During the manipulations the tumor ruptured, and a female fetus, somewhat macerated, escaped. The genital organs were found to be healthy. Both tubes were permeable; the ovaries were slightly cystic. The placenta appeared to be implanted on the great omentum. The inner wall of the cyst was lined with amnion, the former being degenerated in parts. The chorion was also considerably altered.

Such a case as this undoubtedly appears to be one in which a fecundated ovum began its development outside the genital organs. The presence of a strong, thick pedicle attaching the gestation-sac to the pelvis suggests that the ovum was first embedded in the latter position, afterward developing upward, entering in particular into relationship with the omentum, whose rich vascular supply afforded the maternal blood-supply for the intervillous spaces of the placenta. In view of what has been stated already regarding the occasional occurrence of decidual areas in the pelvic peritoneum (possibly, representing detached Müllerian remains), there is no reason why a fecundated ovum might not become embedded in one of these, just as it may sometimes develop in the ovary.

It is stated by some writers that in some cases an early ovum may be expelled from the tube and become attached to the peritoneum, thereafter continuing its development. While such an occurrence may not be impossible in the case of a very early ovum, it must be regarded as highly improbable. Moreover, experiments on animals have demonstrated that young ova re-

moved from the genital tract and placed in the peritoneal cavity are always destroyed.

C. Cornual Pregnancy.—Though not ectopic, a cornual pregnancy is best considered in this connection on account of the close resemblances between them. When, owing to maldevelopment of the Müllerian tracts, a single uterus is not formed, various conditions of the bicornute condition may be produced. To one of these only is it necessary to refer here—viz., that in which one horn is more or less rudimentary. This imperfect horn may become the seat of a pregnancy whether its lumen be continuous with that of the well-formed horn or whether there be no connection between them. In the latter case the ovum must have been fertilized by spermatozoa that passed upward along the healthy horn. Such cases of cornual pregnancy are rare, and are apt to end fatally by rupture into the peritoneal cavity, generally after the third month. In a few instances the ovum has ceased to grow without the occurrence of rupture.

GENERAL CONSIDERATIONS.

Changes in the Ovum after Death when it is Retained *in situ* and not Absorbed nor Altered by Suppuration.—*Mummification* is a change that leads to the shrinkage of the tissues of the ovum by the absorption of fluid from them. The membranes and placenta become shriveled and fibrous, closely enveloping the fetus, which is also much shrunken. Sometimes this process is accompanied by calcareous deposition.

Adipocere transformation consists in an alteration of the tissues of the fetus into a soap-like substance with a golden-yellow tinge. The bones may or may not be altered. Sometimes the change is accompanied by calcareous deposits.

Calcification of the ovum has frequently been described; the membranous placenta and the maternal tissues external to it may alone be affected. In some cases also the fetus may be calcified, the salt being usually deposited superficially, though sometimes it may be scattered throughout the fetal tissue. Occasionally the fetus alone may be the seat of the calcareous change—lithopedion proper. Sometimes the tissue may be so hard as to resemble bone.

Alleged Growth of the Placenta after Death of the Fetus.—It has been held by many that the placenta may continue to grow after fetal death; this view is erroneous. There may be an increase in size, due to extravasation of the maternal blood into its substance from time to time, but the villi of the chorion show only degenerative changes.

Repeated Ectopic Gestation.—It is believed that ectopic pregnancy may occur more than once in the same tube; certainly it is well established that having occurred in one tube, it may take place at a later period in the other. Cases have been reported in which the second gestation has taken place while remains of the first have been present in the tube.

Plural Ectopic Gestation.—Rarely the gestation may occur in each tube at the same time, or two ova may develop at the same time in different parts of the same tube, or a twin pregnancy may develop in one tube.

Concurrent Ectopic and Uterine Gestation.—Sometimes ectopic and uterine gestation may take place concurrently. There is no evidence that a pregnancy may develop in the uterus after an ectopic pregnancy has started to develop,

or as long as its development continues. After an ectopic gestation has ceased to develop, however, whether the ovum has been absorbed or not, pregnancy may take place in the uterus.

Developmental Changes.—*Muscular Part of the Tube-wall.*—There is little doubt that the development of a gestation in the tube induces changes in its musculature similar to those that take place in the uterus during normal pregnancy, hypertrophy and hyperplasia of its fibers occurring. These changes are chiefly marked through the first two or three months, but very slightly afterward, the muscle after an early period being unable to respond to the rapid development of the ovum as does that of the normal fruit-holder—the uterus; the connective tissue, however, increases considerably. The muscle-bundles become thinned, stretched, separated, and irregularly distributed. After the early months large portions of the wall may be found in which no muscle is distinguishable.

Mucous Membrane.—Different opinions are held in regard to the changes in the tubal mucosa. It has been stated by some that no decidual transformation takes place; this view is erroneous. Careful study will usually reveal the presence of decidual cells, though they may frequently be scanty or irregularly distributed. They are best studied in the early months of ampullar tubal gestation. In advanced stages, after the mucosa has been greatly stretched and thinned, the decidual cells are relatively few and scattered, though in parts they may be abundant. When the tube bursts and the ovum develops in the broad ligament, decidual cells are not usually found in non-tubal tissues, even though they be in relation to the placenta. When the ovum develops on a fimbria or other small portion of the Müllerian tract, there must necessarily be very little decidual tissue; and if the pregnancy develops in the midst of the ovary, no decidual cells may be found after an early period. The decidual reaction, as it usually occurs in tubal gestation, may be described as analogous to that which occurs in the uterus in the formation of a decidua vera. The resemblance to the arrangement of the uterine vera may sometimes be very close. There is, however, no uniformity in its production. Sometimes an extensive portion of the mucosa may be altered; sometimes only a limited portion arranged circularly or on one side. In some cases a superficial compact and deep spongy layer may be distinguished. This arrangement may be due to a blending of adjacent portions of the original mucosal fringes near the tube-lumen, the spaces between them resembling the gland-spaces of the normal uterine mucosa. Sometimes the tubal mucosa, especially near the uterus, may considerably resemble the uterine mucosa; in such a condition there will be resemblances after decidual transformation. As the decidual changes progress, the lining epithelium becomes flattened, broken, and degenerated. Many connective-tissue cells are transformed into large decidual cells somewhat similar to those found in the uterus, the most marked development taking place nearest the tube-lumen. The epithelium covering the mucosal folds near the musculature tends to become disintegrated and cats off. The blood-vessels increase in size, the capillaries here and there dilating to form small sinuses.

Decidua Serotina.—That part of the mucosa to which the ovum becomes attached may be termed the decidua serotina. Its condition at the time of the embedding of the ovum has not been described. No tubal pregnancy has

been described as early as the uterine pregnancy described by Hubert Peters. In the earliest specimens described changes are found somewhat similar to those noted in the uterus in normal pregnancy. The blood-vessels are dilated, the capillaries being distended to form large sinuses in the superficial portion of the decidua. The connective tissue shows hypertrophy and hyperplasia of the cells, leading to the formation of characteristic decidual cells, which is most advanced near the surface.

As pregnancy continues the cells tend to lie with their long axes parallel to the surface, due probably to the increasing pressure of the growing ovum. Degeneration also takes place in the cell-substance and nucleus. In many parts their outlines may become very indefinite. A form of coagulation-necrosis occurs, areas of the tissue having a fibrinous or hyaline appearance under the microscope. Of special interest is the occasional proliferation of the endothelium in some of the large sinuses, forming a layer of several thicknesses of cells, which in some instances may extend somewhat into the surrounding decidual tissue. This has not been observed in uterine pregnancy, but has been observed in the hedge-hog by Hubrecht.

The arteries and veins present appearances similar to those found in the decidua of uterine pregnancy.

Decidua Reflexa.—There has been much dispute as to the formation of a reflexa in tubal pregnancy. Some deny its existence; others, while admitting that it may be present, express different views as regards its formation. Owing to the smallness of the tube it is probable that in some cases a distinct reflexa may never be able to form, the gap formed in the mucosa by the embedding of the ovum being closed by the opposite side of the tube; in some cases a reflexa may be partially formed, blending immediately with the adjacent mucosa lining the tube. That the complete reflexa may be formed cannot be denied, for specimens have been described. It has a structure similar to that of the neighboring serotina. Degeneration takes place in it very rapidly, and there is a great tendency to rupture of blood-vessels in its substance.

Where the ovum is not early destroyed, the reflexa becomes stretched and thinned and pressed against the surrounding portion of the wall of the tube, gradually disappearing.

Relations Between Ovum and Decidua.—The relationships between the ovum and decidua in tubal pregnancy have not been described at such an early date as in the case of uterine pregnancy, but the information given by many preparations within the first month of gestation and later suggests strongly that in the beginning the conditions are similar to those found in uterine gestation. The surface of the serotina next to the ovum, forming the maternal boundary of the intervillous spaces, is somewhat irregular. By the end of the first month a thin layer of hyaline degeneration is usually present near the surface. Masses of syncytium, varying in shape and size, are attached to the surface; in some parts the syncytium forms a distinct layer. Below the surface portions extend in various directions, even into the musculature of the tube-wall. They may also extend into the blood-sinuses in the decidua, and portions may be carried away in the veins.

The maternal blood-sinuses communicate with the intervillous space by openings of various sizes, and occasionally syncytium is seen in the process of absorbing the decidual tissue between the sinus and the surface of the decidua.

Chorion.—A detailed description of the chorion is unnecessary, since it is identical with that which has already been given in the description of uterine pregnancy. The villi are attached to the serotina and the reflexa in the same manner. Great variations are found as regards the extent of degenerative changes in the early villi, leading to atrophy and disappearance. In some cases these correspond to the changes found in uterine pregnancy, for the chorion may become differentiated into a placental and a nonplacental portion; and in some cases the placenta may have a typical discoid shape. Much more frequently there is irregularity of chorionic development. Sometimes the majority of the villi may remain functional, forming a placenta that in early pregnancy fills almost the entire cavity in which the ovum develops. Sometimes the placenta may have an irregular, ring-shaped character.

Amnion.—The amnion is the same as found in uterine gestation.

Tubal Mucosa Outside of the Sac containing the Ovum.—Great variations are found in this part of the mucosa. Decidual cells may be present in more or less of its extent, though as pregnancy advances they tend to disappear.

Blood is frequently found in this part of the lumen, and may cause considerable flattening of the mucosal folds against the wall or may mass them in irregular heaps. As the gestation increases more of the tube is occupied, and the mucosal folds external to the sac become greatly altered, the epithelium becoming somewhat flattened and frequently cast off.

SYMPTOMS AND SIGNS.

Those Due to the Pregnancy per se.—Sometimes they may be the same as those of normal pregnancy, the ectopic gestation reaching an advanced stage, being regarded as a normal uterine pregnancy both by the woman and her physician. Such cases are, however, very rare. In the great majority of instances there are variations, both in signs and symptoms, which are suggestive of an abnormal condition, though there are no subjective symptoms of such marked character as may indicate to the woman the peculiar nature of her condition. With regard to physical examination, it may be said that there are very few cases in which a thorough study should not enable the physician to suspect, if not to establish, the character of the gestation. The constitutional and sympathetic changes occur with great variations. While these may be as well marked as in normal labor, they are frequently less distinct. The breasts, for example, in ectopic pregnancy may at the fourth month present very little pigmentation, enlargement, or colostrum formation. The discoloration of the vagina is frequently slightly marked. It must be remembered, however, that such peculiarities may occasionally be found in uterine pregnancy.

Menstruation.—Great variations are found as regards the menstrual function. It may cease entirely in a number of cases throughout pregnancy; it may take place regularly for the first few months and not afterward; it may be regular at first and then irregular; or it may occur at irregular intervals throughout pregnancy. The amount of blood also varies greatly; sometimes the flow may consist of only a few drops; sometimes it may last for one or more weeks. In some cases there is considerable pain in the region of the uterus in connection with the periods, but in other cases there may be little or no suffering.

Periodic Colicky Pains.—Such pains are frequently experienced, especially after the second month, though in some cases they are entirely absent. The intervals between them vary considerably. Each attack consists of irregular, intermittent pains, felt in the region of the gestation or in the lower abdomen. The explanation of these pains has been a matter of some difference of opinion. They are believed to be due to contractions of the gestation-sac or of the uterus. It is probable that they cannot be caused by the former after the early months, because of the relatively small amount of muscular tissue in the wall. Hemorrhage in the wall of the tube or in the lumen probably explains the pain in many cases. In other instances it is possible that inflammatory changes cause the disturbance.

With regard to the uterus, there can be no doubt that contractions in its musculature are frequently present. Sometimes they are marked, and indicate the efforts of the organ to expel the decidua that lines it.

Discharge of the Uterine Decidua.

—Very frequently portions of the lining of the uterine mucosa are expelled with more or less blood during the course of an ectopic pregnancy, often with much uterine pain. Sometimes a complete cast of the uterine cavity may be shed. This tissue presents characteristic changes similar to those found in the decidua vera in normal uterine pregnancy.

Changes in the Breasts.—Mammary changes, while similar to those found in normal pregnancy, are, as a rule, not so pronounced. If the gestation comes to an end, retrogressive alterations occur, though sometimes, when cases reach full term and undergo a spurious labor accompanied by the death of the fetus, increased secretion of milk occurs.

Abdominal Enlargement.—In uterine gestation, after the third month, there



Fig. 353.—Complete decidual cast of uterus in a case of tubal gestation.

is a fairly constant progressive rate and form of increase in the size of the abdomen; in ectopic gestation there is less uniformity. The more advanced the gestation, the more do the abdominal swellings in the different ectopic varieties tend to resemble one another, and the shape of the abdomen may resemble considerably that found in normal cases. In the majority of instances, however, the increase of the abdomen, especially during the first five or six months, is mainly one-sided. Frequently a tubal pregnancy growing in one side and not falling below the pelvic brim may, within the first three months, form a swelling in the iliac region, noticeable to the woman or to others. Many cases, however, form no apparent swelling above the brim until they have developed to a great extent below it. Those cases which rupture into the

broad ligament and develop upward are particularly liable to be noticed as irregular lateral swellings.

Fetal Movements.—Fetal movements are felt by the mother first usually between the fourth and fifth months, as in normal pregnancy, variations being found; in a number of cases they may be felt earlier and more distinctly than in normal uterine pregnancy, probable owing to the greater thinness of the gestation-sac. Frequently the movements are felt first on one side. In early ectopic sacs that lie close to the abdominal wall they may frequently be detected by auscultation before the mother feels them, and more readily than in uterine pregnancy. After midterm they may often be felt and heard with very great distinctness if the intestines do not intervene between the gestation-sac



Fig. 354.—Specimen of ruptured right tubal pregnancy.

and the anterior abdominal wall. When fetal heart-sounds are heard, they ordinarily appear distinct, though there are great variations, according to the health of the fetus, its position, and other factors.

Maternal Souffle.—The souffle may frequently be heard in one or both iliac regions, great variations being found. It may be absent, faint, or very loud. It is most pronounced close to the gestation-sac.

Changes in the Vagina.—The walls of the vagina become soft, lax, and dark in color as in normal pregnancy, though these changes are not usually so pronounced.

Changes in the Uterus.—The cervix becomes somewhat softened and darker in color, though not usually to the extent found in uterine pregnancy. The whole organ enlarges, the extent varying in different cases. It retains

the nonpregnant shape, and the body does not become rounded as in normal pregnancy, nor does any special softening occur above the cervix. The latter frequently becomes patulous, especially during the periods of contractions in the organ. Bandl has stated that uterine enlargement is greater the nearer to the organ the ovum is developed. In the majority of cases it is between 4 and 5 inches in length; sometimes, however, it may be as much as 7 or 8 inches. The mucosa shows marked alterations similar to those found in the decidua vera of normal uterine pregnancy. These changes are constant; sometimes, however, on examining the interior of the uterus no decidual tissue may be found, owing to its previous expulsion.

Phenomena Noted at Full Time.—When an ectopic gestation advances to full term there usually occurs what has been termed “spurious labor,” characterized by the occurrence of a series of pains resembling those of normal labor. A number of cases are on record where the patient has been attended under such circumstances in the belief that normal labor was taking place. Sometimes these pains develop prematurely during the seventh or eighth month. The duration of the spurious labor varies; it may last hours or even days. When they once cease, there is usually no return, though sometimes there may be. There has been some difference of opinion as regards the cause of these pains. There can be little doubt they are due to uterine contractions. The gestation-sac can take no part in their production except in the case of an interstitial pregnancy or possibly a cornual pregnancy.

The pains are accompanied by dilation of the cervix, by expulsion of mucus, and, frequently, blood and decidual tissue.

The fetus probably always dies at the time of spurious labor, though it is possible it may occasionally live to a later period. Voluntary straining efforts are frequently made by the patient during the pains, and this may cause compression or separation of the placenta, leading to death of the fetus. After the death of the fetus the abdomen usually diminishes somewhat in size, the liquor amnii becoming absorbed. If the fetus is not removed, it may become enveloped in placenta and membranes, and may undergo one or other of the changes that have already been described. In some cases the amniotic fluid slowly diminishes, but it may occasionally increase.

SYMPTOMS AND SIGNS DUE TO COMPLICATIONS.

Pressure Effects.—Displacement of the bladder may take place in several directions, and the various well-known disturbances of micturition may result.

In the early months there is trouble when the gestation-sac falls on the bladder or behind the uterus; in the latter position its growth leads to pressure of the former against the pubes. In extraperitoneal development the ovum may come into close relationship with the bladder-wall. The ureters may also be interfered with and the renal functions thereby altered. Pressure on the rectum is apt to lead to constipation; diarrhea may also be caused. Interference with vessels may lead to edema or varicosity of the external genitals or lower extremities. Pressure on nerves may also lead to pain in the pelvis and lower extremities.

Peritonitis.—Acute peritonitis is very rare in ectopic pregnancy. It may sometimes follow rupture of the tube into the abdomen, or may follow septic

changes in the gestation-sac with invasion of the peritoneum. Chronic peritonitis is frequently found, causing changes in the wall of the gestation-sac and leading to adhesions between it and the surrounding structures. In the majority of cases this is merely the continuance of an inflammatory process that existed before the pregnancy.

Pain.—Various forms of pain are found in ectopic pregnancy. Those of a somewhat labor-like character that occur at intervals have already been described. Suffering may also occur from mechanic pressure of the gestation-sac on nerves in the pelvis and abdomen, and may also be caused by vigorous movements of the fetus in the advanced months. Reference has already been made to pains that occur in connection with spurious labor. Peritonitis may in some cases lead to suffering, but in many cases it is not marked by any pain whatever. Rupture of the gestation-sac into the broad ligament or into the peritoneal cavity may often be associated with pain, though in some cases it is slight or absent. Hemorrhage into the gestation-sac may also cause distress.

Phenomena Accompanying Hemorrhage.—The symptoms of hemorrhage in connection with ectopic pregnancy vary greatly, depending upon the size and site of the hemorrhage. In cases of great loss of blood there are symptoms of shock and acute anemia. Pain may be present, varying greatly in various cases. When a hematocoele or hematoma is formed; various pressure effects may follow, *i. e.*, interference with the functions of the rectum, ureters, bladder, etc.

Infection.—When septic micro-organisms invade an ectopic pregnancy, various changes may be produced that are found in septic processes occurring apart from pregnancy. Suppuration, leading to the formation of a collection of pus, runs the same course as in other pelvic or abdominal abscesses.

Interference with the Digestive Tract.—Pressure on the rectum has already been described. As a result of chronic peritonitis, leading to adhesions among the intestines, there may be the ordinary disturbances associated with that complication when pregnancy is not present. When the gestation reaches an advanced period, the most marked alimentary disturbances are likely to be found, though they occur with many variations; in some instances there may be very little disturbance either in connection with the stomach or intestines.

Rupture of the Gestation-sac.—The symptoms and signs following rupture of the gestation-sac vary greatly. They depend mainly upon the nature of the rupture, the site of the rupture, and the amount of blood lost, the complication of infection, etc.

At the time of spurious labor the sac may sometimes burst. Rarely does this take place so that the fetus escapes into some part of the peritoneal cavity or into the vagina. Sometimes it may enter the large intestine. An interstitial pregnancy may burst into the uterine cavity. When suppuration occurs, the fetal tissues may escape by the bowel, bladder, vagina, or parietes.

Changes Following Death of the Fetus.—If the maternal souffle has been present, it gradually disappears. Labor-like pains may be felt, and these may recur at later periods. Menstruation usually returns, though not in any definite or regular manner. The abdomen usually diminishes in size, though in some cases it may not change much. If no suppuration occurs, the mass may be carried for many years and cause little or no trouble to the woman.

DIAGNOSIS.

The difficulty of establishing an accurate diagnosis in ectopic gestation is largely due to the great variations in the signs and symptoms that may be present. In studying any given case it is necessary to prove that there is no pregnancy in the uterus, that an abdominal swelling exists, and that it is due to the ectopic development of an ovum. The most important factor in establishing the diagnosis is the physical examination of the pelvis and abdomen, especially by the abdominorectovaginal bimanual method.

An anesthetic should always be employed when there is uncertainty. The great difference between uterine and ectopic pregnancy is that the physical changes in the abdomen and pelvis occur fairly uniformly in the former and with great variability in the latter.

Relaxation, softening, and discoloration of the walls of the vagina, though usually present, are often not very well marked. They are most developed in cases of advanced pregnancy. Increased pulsation of vessels as found on vaginal examination occurs with great variability. The shape and position of the vagina are altered in different ways. Sometimes there is little change; sometimes there is marked shortening, especially when the uterus is pushed downward by the gestation-sac. There may be marked displacement forward, backward, or laterally. The position of the uterus is likewise subject to many alterations. In the early months it may not be much changed; later it is frequently pushed upward and forward or displaced laterally; occasionally it is pushed directly downward, or may be retroposed or retroverted. It may occasionally be considerably rotated. Changes in its size have already been noted, though frequently it is impossible to measure the organ owing to the impossibility of outlining its upper end. A sound must never be used when there are doubts as regards the existence of uterine gestation. When the uterus can be entirely palpated, it does not present the alteration found in normal pregnancy. It is firmer and does not become especially soft above the cervix. In some cases it may be felt distinct from the gestation-sac; in others it is so related to it that it appears to be only a firm portion of its wall. In other cases it is so incorporated that it cannot be felt in any way distinct from it. In some cases when bimanual examination is employed fluctuation may be obtained in the liquor amnii, ballottement may be found, and the fetal movements may be felt. In other cases it is impossible to determine these points, owing to the thickness of a placenta situated anteriorly and the presence of extravasated blood or other complications.

Various conditions must be considered in establishing the diagnosis of ectopic pregnancy.

1. **Uterine Pregnancy.**—In the early weeks of normal pregnancy a pelvic swelling lying alongside the uterus may be regarded as an ectopic sac, the enlargement of the uterus being attributed to the influence of the former. If the uterus had formerly been hardened by chronic metritis the mistake is more liable to be made, but it is especially when there is some irregularity in the ordinary signs and symptoms, *i. e.*, a discharge of blood from the uterus, that the risk of making a mistake is increased.

In advanced uterine pregnancy error may be made, especially when the wall of the uterus is thin and the liquor amnii scanty, allowing the fetal parts

to be easily palpated. Error may also be made when the uterus is displaced markedly to one side by old adhesions, by a tumor, or by a loaded portion of bowel. It may also occur when there is a fibroid tumor in the wall of the uterus.

Ectopic gestation may also be mistaken for uterine pregnancy, especially in the advanced months, though an interstitial gestation might be mistaken during any month. In some cases error may be made even after the most careful examination.

2. **Retroversion of the Gravid Uterus.**—Ectopic pregnancy has often been mistaken for this condition, chiefly in the early months. The error should rarely be made if a thorough anesthetic examination is carried out. Similarly, retroversion of the pregnant uterus has been mistaken for ectopic pregnancy. It is important to note the following symptoms and signs resulting from pressure of the displaced gravid uterus, viz., difficulty in micturition, retention of urine, overdistention of the bladder, constipation, and pains in the pelvis and thighs. If the bladder be overdistended, it is felt as a round or oval tumor above the symphysis. The cervix uteri is generally close behind the latter. The body of the uterus is felt as a soft cystic swelling in the pouch of Douglas, continuous with the cervix.

3. **Sacculation of the Uterus.**—When sacculation of the anterior or posterior wall of the uterus occurs, with displacement of the cervix, the condition may exactly resemble an ectopic gestation.

4. **Tumor of the Ovary.**—This may be mistaken for ectopic pregnancy under various circumstances. A small tumor developing in the pelvis or burrowing beneath the broad ligament, displacing the uterus, may simulate the condition. When there is a large tumor, error may be made if the uterus be adherent to it, especially if there be an irregular menstrual history, accompanied by some of the minor signs and symptoms of pregnancy. Torsion of the pedicle may result in many of the signs and symptoms associated with rupture of blood-vessels in an ectopic sac. When uterine pregnancy is complicated with an ovarian tumor, an error in diagnosis is very apt to arise. A tumor associated with a uterus from which an incomplete early abortion has passed may be difficult to diagnose from ectopic gestation.

5. What has been said of ovarian cysts applies to other pelvic swellings, *i. e.*, those arising in the tube or broad ligaments.

6. **Fibromyomatous or Fibrocystic Tumors.**—Ordinary fibroid tumors are generally easily distinguished from ectopic pregnancy. Sometimes an intramural growth may simulate markedly an interstitial gestation. A large irregular fibroid mass may sometimes be mistaken for an ectopic gestation that has reached an advanced period. Death of the fetus then occurs, followed by absorption of the liquor amnii. Occasionally the occurrence of a local peritonitis in connection with a fibroid uterus may simulate an ectopic pregnancy in which rupture has occurred.

7. **Pelvic Hematocele and Hematoma.**—The occurrence of an outpouring of blood in the peritoneal cavity or the cellular tissue of the pelvis apart from ectopic pregnancy may be very difficult to diagnose from the latter condition. In this connection it should always be remembered that the most frequent cause of such hemorrhage is undoubtedly ectopic gestation.

It is necessary that the case should be studied with the greatest care, be-

cause of the risks to the life of the patient that follow the rupture of ectopic gestation-sacs.

8. **Inflammatory Swellings in the Pelvis.**—Various swellings that may be produced in the pelvis as the result of inflammation must be diagnosed from ectopic pregnancy. The risk of making an error is greater when the uterus has been recently pregnant or when the inflammation complicates actual normal pregnancy.

9. **Malignant swellings** occasionally cause error in diagnosis. In most cases the error has been due to the formation of a malignant swelling resembling somewhat the shape of the fetus in its gestation-sac. Sometimes such a condition may be very perplexing when it is found at the time of the menopause,

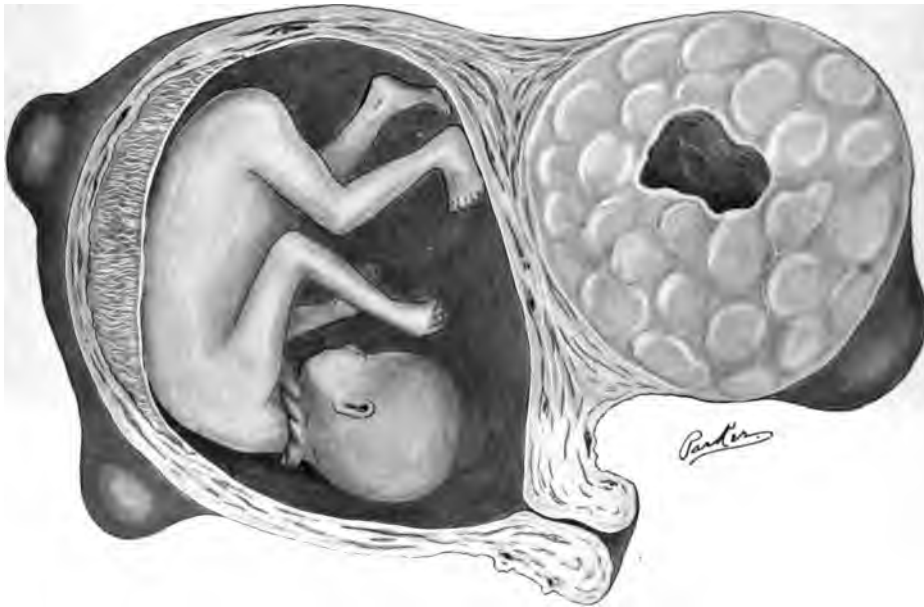


Fig. 355.—Pregnant uterus with fibroids. In the center of the large fibroid a cystic area is seen.

especially if menstrual irregularities and some of the minor changes usually found in pregnancy be present.

10. **Gestation in the Rudimentary Horn of a Malformed Uterus.**—This condition can be definitely diagnosed from ectopic pregnancy only if the shape of the malformed horn can be accurately outlined. This is rarely done, but for practical purposes accuracy is not necessary, since both conditions demand the same treatment.

11. **Gestation in a Well-formed Bicornute Uterus.**—When one half of a bicornute uterus is pregnant, the condition may strongly resemble an ectopic gestation. In the former case the finger may usually feel the fetus in advanced pregnancy if the cervix be patulous.

12. **Spurious Pregnancy.**—This condition may be mistaken for ectopic pregnancy. The menses may cease for several months or may be irregular.

There may be changes in the breasts, and various other manifestations of pregnancy. When the uterus is found empty on bimanual examination it may be thought that an ectopic gestation is present, especially if there be a swelling of



Fig. 356.—Ruptured left cornual pregnancy. There was no communication between this horn and the right nonpregnant portion.

any kind in the abdomen or pelvis. In such cases an anesthetic examination should always be made.

13. Various other conditions may simulate rupture of a gestation-sac, *i. e.*, acute intestinal obstruction, perforation of the intestines, rupture of an aneurysm, renal and biliary colic, torsion of the pedicle of a tumor, etc.

TREATMENT.

(a) **When the Gestation is Confined to its Original Site in the Ampullar or Infundibular Portion of the Tube or in the Ovary.**—As soon as the diagnosis is established the patient should be kept at rest, in order to avoid any form of exertion that might bring about rupture of the gestation-sac. Abdominal section should be carried out and the gestation removed, the procedure being the same as in the case of the removal of a tube much altered by disease.

In such conditions the chief difficulty arises when the gestation-sac is impacted in the pelvis or is extensively adherent to surrounding structures. If the sac be ruptured during operation, considerable hemorrhage may result. It is, therefore, always advisable to ligate the ovarian artery on the affected side before attempting to dissect out the tube. When the gestation-sac oc-

cupies a considerable portion of the abdomen and is so adherent that its removal is impossible without dangerous loss of blood, it may be advisable to carry out a procedure similar to that described in connection with subperitoneo-abdominal cases.

(b) **Interstitial Tubal Pregnancy.**—Several cases have been reported in which the cervix has been dilated and the septum between the uterine cavity and the gestation-sac divided so as to allow the removal of the ovum. This procedure should only be undertaken in the early months, when there is considerable probability that it may be satisfactorily accomplished or when there is some contraindication to abdominal section. The chief risk is that the outer wall of the gestation-sac may be ruptured, leading to extra-uterine hemorrhage. This is most likely to occur in separating the placenta manually. After the removal of the pregnancy the cavity should be packed with gauze for several days.

In a great majority of these cases, however, abdominal section is the safest procedure; if the gestation be not too far advanced, it may be possible to remove the pregnant portion of the uterus, closing the cavity as after a myomectomy. When the gestation is advanced, however, it is advisable to remove the whole uterus, as in the operation of hysterectomy for a large fibroid.

(c) **When the Gestation-sac has Ruptured into the Peritoneal Cavity.**—When rupture is accompanied with acute symptoms of loss of blood, abdominal section is indicated. All precautions should be taken to counteract the influence of the blood-loss before and during the operative procedure, *i. e.*, the introduction of normal saline solution into the system, and the latter should be quickly carried out. In opening the abdomen it is imperative first of all to find the place of rupture, in order that the bleeding vessels may be controlled. Also the ovarian vessels on the side of the gestation should be early clamped or ligated. If the tear be large or irregular, it may be impossible to do this quickly, or attempts at compression may increase the size of the tear. In such cases the assistants should compress both broad ligaments while the operator carries out his manipulations.

The gestation-sac should be removed as would be an inflammatory swelling, and complications should be treated in the ordinary manner.

In cases of rupture in which dangerous loss of blood has not at once occurred, but a succession of small hemorrhages, abdominal section is also advisable. Cases seen after hemorrhage has ceased may be treated expectantly, in order that the hematocele may have a chance to absorb. If this does not take place with reasonable rapidity, operation should be carried out, the blood-clots removed, and the gestation-sac taken away, if possible. Abdominal or vaginal drainage may be necessary afterward.

The gestation-sac being removed, the operation is very likely to be complicated in such conditions by the presence of numerous adhesions and by blood-clots in all stages of formation. The most careful technic must be observed, the clots being carefully removed, and the abdominal cavity being flushed out with normal saline solution.

In the rare cases in which after the rupture of the primary sac the fetus escapes in its membranes and continues to grow in the peritoneal cavity, abdominal section should also be carried out. The secondary sac should be opened first of all, the fetus and amniotic fluid being removed. Thereafter, if the

primary sac is movable and the adhesions surrounding it easily divided, the mass containing the placenta should be taken away. As much of the amnion as is loosely attached may be stripped away. It should not be forcibly torn off, however, because of the danger of injuring the viscera. When the primary sac is too firmly embedded in the pelvis or in adhesions to allow of its safe removal, the ovarian artery of the affected side should, at least, be ligated. The umbilical cord should be brought to the lower end of the abdominal incision and a gauze tampon inserted from the latter down to the placenta.

After four or five days the patient should be anesthetized, the packing removed, and an effort made to detach the placenta. Sometimes only a portion of it may be taken away at this time. The cavity should be again packed, and the rest of the placenta be removed several days later. The cavity is afterward allowed to close gradually.

(d) When the Primary Gestation Ruptures into the Broad Ligament.

—At the time of primary rupture the patient should be placed at rest in bed, a simple light diet being administered, and an ice-coil or ice-bag should be placed over the lower abdominal region, ergot being administered internally. The pelvis should be examined from time to time, in order to determine if the mass tends to increase in size. If the ovum be destroyed, no further treatment may be necessary, in some cases the swelling in the broad ligament gradually disappearing. If the disappearance takes place very slowly or pressure symptoms are present, it is wise to make a vaginal incision into the mass, remove blood-clots, and pack the cavity with antiseptic gauze.

In cases in which after rupture the ovum continues to develop, so that the swelling reaches upward into the abdomen, it is sometimes possible to carry out vaginal operation. This should be done when the amniotic cavity is felt to bulge downward behind the uterus, the placenta being above the level of the fornix. By incising the gestation-sac the liquor amnii and fetus may be removed. An antiseptic gauze tampon may then be inserted into the sac, which gradually shrinks. After four or five days the gauze may be removed and an effort made to take away part or all of the placenta. The cavity should be again packed, and should afterward be treated as a pelvic abscess cavity.

When the placenta is situated low in the pelvis or the gestation-sac has advanced several inches above the brim of the pelvis, the abdominal route should be selected and a mesial or lateral incision made, the sac opened, the fetus and liquor amnii extracted, and the cavity packed with antiseptic gauze, the umbilical cord being carried into the abdominal wound. The edges of the gestation-sac should be stitched to the edges of the abdominal incision. This method of treatment may be greatly complicated if the abdominal incision is made through the placental area, as the loss of blood may be very rapid. To lessen this risk the cavity should be packed with the greatest rapidity.

After four or five days the gauze should be removed and the placenta entirely or partially taken away. No force should be employed in this procedure. Thereafter the cavity may be packed every few days until it gradually shrinks and closes. Removal of the placenta at the time of primary operation is not advisable on account of the danger of hemorrhage. In cases in which infection of the cavity may follow this procedure, the healing process is delayed. It may be greatly hastened if a vaginal incision can be safely made into the sac, so that downward drainage may be carried out.

(e) **When, after Rupture of the Primary Gestation-sac into the Broad Ligament, Rupture takes place into the Peritoneal Cavity.**—When secondary rupture occurs soon after the primary rupture, abdominal section must be carried out and the case treated on the lines laid down for the management of primary rupture of the gestation-sac into the peritoneal cavity. When the rupture occurs after the ovum has been developing extraperitoneally for some time, the abdominal cavity should be opened, the vessels in the edges of the tear closed, and the latter stitched to the edge of the abdominal incision if near enough.

If the rent be too far from the abdominal wall, it should be closed with cat-gut, the peritoneal cavity flushed out with normal saline solution, and the sac opened anteriorly, being treated in the manner already described.

(f) **When the Case has Reached the Advanced Months of Pregnancy.**—Abdominal section in always indicated. There should be no delay unless at the express desire of the parents, in order to take chances of securing a more fully developed fetus. Such a course is, however, unwise, as delay adds to the risks and discomforts of the mother. As regards the fetus, there is great uncertainty.

In the case of ectopic pregnancy the fetus is less robust than in the case of uterine pregnancy, and there is great liability to death at or near full term. When the operation is carried out after there has been a spurious labor, followed by death of the child, the risks of hemorrhage are much reduced and the chance of removing the placenta considerable.

When the fetus has been long dead and it has been mummified, transformed into adipocere or a lithopedion, removal by abdominal section is always indicated. The fetus should be taken out, and its membranes or sac with it, if they be easily detachable.

(g) **When Suppuration has taken place in an Old or Recent Gestation.**—In these conditions the procedure usually adopted for pelvic or abdominal abscesses should be employed. The vaginal incision should be chosen if possible. If the abdominal route be selected, care should be taken not to infect the peritoneal cavity. In cases of spontaneous rupture of the infected sac there may be great delay in the healing if the fetus has been so far advanced that its skeleton has been well formed. Its bones pass out very slowly and may greatly impede the escape of pus. It may be necessary to remove the contents by hands or instruments, and an incision may be required.

(h) **When there is a Combination of Ectopic and Normal Uterine Pregnancy.**—When the gestation is of old standing, as in the case of a lithopedion, a uterine gestation may sometimes progress normally and be delivered satisfactorily. Sometimes premature emptying of the uterus may result from the interference caused by the old gestation mass. In other cases full time may be reached, but labor may be obstructed and artificial delivery may be necessary. When an ectopic gestation is in the condition of active growth, the complication is very serious. Rarely a uterine pregnancy may go to full term and delivery occur without rupture of the ectopic sac; the latter occurrence is, however, likely to occur. Usually in such a condition it is advisable to carry out abdominal section, removing the ectopic gestation and allowing the uterine pregnancy to continue. Sometimes it may be necessary to terminate the latter also, though such a procedure greatly increases the risk to the mother.

(i) **Ovarian Pregnancy.**—The treatment is the same as that of tubal gestation.

(j) **Rudimentary-horn Gestation.**—This condition is a grave one, and is to be treated according to the rules laid down for the management of tubal pregnancy.

CHAPTER XXII.

APPENDICITIS IN RELATION TO PELVIC DISEASE.

Within recent years gynecologists have begun to make a careful examination of the vermiform appendix in the course of abdominal operations for diseases of the internal genital organs, and it is now the practice of many to remove the appendix in all cases in which it is not entirely normal. The author finds it advisable to carry out this procedure in about 50 per cent. of the cases in which he opens the abdomen.

The frequent association of pelvic and appendiceal diseases has led to the belief, in the minds of many operators, that there is a special relationship between them.

Others, however, hold that this view is fanciful, and state that, if it be correct, appendicitis should be much more common in women than in men, whereas the universal opinion seems to be that the disease is about three times as frequent in males as in females. Recently, Howard Kelly has pointed out, after a careful study of the records of the Johns Hopkins Hospital, that, in a total of over 900 cases of appendiceal disease admitted to all departments of the institution, the number occurring in females is slightly greater than in males. The largest percentage of severe acute attacks, especially those associated with general peritonitis, was found among males. It is likely that other hospital statistics will correspond more or less closely to the findings in Johns Hopkins, if the records of the gynecologic department be examined as well as the general surgical. In a very large percentage of cases the appendiceal disorder is not discovered until the abdomen is opened, either not having been suspected previously or having been diagnosed as pelvic or other disease. Such cases should be included in a classification even though no acute attack had ever taken place.

While it is not possible at present to give numerous accurate data regarding the relative frequency of appendicitis in males and females, it is quite certain, at least, that it is not more common among females than in males. If, however, a comparison be made between females who are healthy and those who have pelvic disease, appendicitis is undoubtedly much more common in the latter class, or, in other words, pelvic disease, especially that due to infection, is to be regarded as a cause of inflammation in and around the appendix. Primary infections in the latter must also be included among the causes of inflammatory processes in the pelvic peritoneum and viscera, though this relationship is scarcely yet recognized by the majority of gynecologists. However, in a very large percentage of cases in which disease is present both in the appendix and in the pelvic structures they are infected independently.

Various writers have endeavored to establish a special connection between the appendix and right appendages, finding therein an important reason for the frequency with which inflammatory changes are present in both. A

special ligamentous band has, indeed, been described as extending between the right ovary and the appendix, these structures being directly connected by lymphatics. Clado has given the name of "appendiculo-ovarian" to this ligament. Careful examination of the pelvis proves that there is no justification for describing such a structure, which is nothing more or less than a slight ridge on the parietal peritoneum extending upward from the infundibulopelvic or suspensory ligament of the ovary, which is simply the outermost portion of the broad ligament. Only in a small percentage of cases does this ridge extend toward the mesentery of the appendix. In the great majority of cases it is directed toward various points in the region of the head of the cecum, or does not exist at all as a distinct peritoneal fold. Embryologic study proves that no special relationship exists between the appendix and the ovary. The latter, at first, lies near the kidney in the upper abdominal region. The path of its descent toward the pelvis is marked by its vessels, and the infundibulopelvic ligament represents merely the last stage in its downward progress. That it passes close to the appendix and cecum is quite evident, but it has no more organic relationship to them than to the ureter. It is not surprising that a peritoneal fold should often extend upward toward them from the infundibulopelvic ligament, but this must be regarded as an accidental and entirely unimportant arrangement. It is true that an artery may sometimes pass from the ovarian artery to the appendix, but the same may be found in the male, and the peculiarity is very inconstant in each sex.

The statement of Clado and Lafforgue that a special lymphatic connection between the internal genitals and the appendix exists along the route of the so-called "appendiculo-ovarian ligament" is open to considerable criticism. Howard Kelly, in his recent work, shows that the lymphatic relationship must be very indirect. The lymphatics of the appendix drain mainly through the meso-appendix into the ileocolic glands; though, occasionally, a few small vessels pass from the proximal portion of the appendix into the cecal trunks. The subserosal lymphatics of the cecum anastomose with those of the neighboring peritoneum, and in this way, as Kelly states, an insignificant connection may exist between the appendix and cecum, on the one hand, and the iliac and lumbar glands on the other. The lymphatics of the tube and ovary pass to the lumbar glands, anastomosing with the small vessels of the parietal peritoneum in their neighborhood. It is, therefore, evident that the appendix and the genitalia are not directly or specially connected by lymphatic chains, and it is doubtful if the lymphatic system plays an important part in the transmission of infection from one structure to the other.

Of far greater importance is the relationship of contiguity. In the normal position of the appendix it is not very far removed from the normally placed right tube and ovary, but in a very considerable percentage of women the appendix alone, or with the cecum, may lie below the pelvic brim. It is not, therefore, surprising that an infective process arising in the appendix may extend to the right appendages or other structures in the neighborhood along the peritoneal surface, or that from an infected tube there may be an extension to the region of the appendix. In the same way viscera in the neighborhood of an infected gall-bladder may be involved, though not actually in contact with the latter. Similarly, in the left side of the pelvis the great frequency of adhesions between the sigmoid flexure and the left broad or round ligament or

uterine appendages suggests the spread of infection from bowel or tube, probably most frequently from the latter.

An infective process arising in the appendix may cause it to become adherent to the pelvic peritoneum, the right tube or ovary, broad ligament, round ligament, uterus, or bladder without the formation of pus. The adhesions may be slight and filamentous or dense and thick. In other cases the infection may extend to these structures, though the appendix does not become adherent; in this way the outer end of the tube may sometimes become closed or buried in adhesions. Sometimes the cecum becomes adherent to the right broad ligament or adnexa. In some cases peritonitis may extend to the deep portions of the pelvis. It is rare that the left appendages are involved, but they may be if the appendix be very long and displaced downward and to the left.

Pelvic suppurative processes may also be secondary to appendicitis. Rotter, in 1890, collected a series of 132 abscesses following appendicitis, and found that 40 were pelvic; in 27 of the latter the appendix was in the pelvis. The pelvic abscess may be associated with pus in the right iliac fossa or elsewhere; very rarely in the left iliac fossa. It is important that while iliac and pelvic abscesses may be continuous, they are usually distinct from one another.

The appendix may sometimes be connected with the abscess cavity, but in other cases may be at some distance from it. Occasionally, the abscess may involve the tube or ovary or both of these in combination.

Infection extending upward from the Fallopian tube may lead to involvement of the appendix or cecum, both in suppurative and in nonsuppurative conditions, whether the appendix is in contact with or at some distance from the right appendages. These undoubtedly form the majority of the cases in which coexisting disease is found in these structures. The same variations in pathologic conditions may occur which have already been mentioned as occurring in cases in which the infection is primary in the appendix. In tuberculosis of the right appendages the appendix and neighboring peritoneum may be involved. In one case in which the author operated the tip of the appendix, the distended tube and small intestine were adherent at one point, and in communication.

Pelvic new-growths may enter into relationship with the appendix in various ways. The latter may be compressed between a tumor and the parietes. It may become adherent or, sometimes, it may be considerably displaced by the upward extension of a tumor, especially one developing extraperitoneally. Adhesions may possibly in some cases be due to pressure, but in most cases they are due to primary appendicitis, extension of infection from the Fallopian tube, torsion of the pedicle of a tumor, or escape of its contents. Suppuration of the new-growth may in some cases be started by an acute appendicitis.

The sac of an ectopic gestation may enter into very intimate relationships with the appendix either by its extraperitoneal development, by direct contact and adhesion-formation, or by extravasation of blood. An onset of acute appendicitis under such circumstances may lead to suppuration in the ectopic mass.

In view of the facts which have been stated it is evident that, in the treatment of pelvic disease in the female, the possibility of the coexistence of appendiceal disease should always be kept in mind, and should exercise an influence on the course of treatment adopted. It should always be considered when there is a discussion as to whether an operation should be carried out by

the abdominal or the vaginal route. Indeed, it is certain that the extensive adoption of the latter is bound to leave untouched associated appendiceal disease in a considerable percentage of cases, and, in some instances, this may mean placing the life of the patient in jeopardy. Moreover, in complicated cases in which the appendix is densely adherent to pelvic structures it may be torn across by the manipulations, causing very serious complications. In evacuating pelvic abscesses through the vagina the possibility of an appendiceal abscess or of the coexistence of another abscess at a higher level should be kept in mind and a guarded prognosis given.

In every case of abdominal section for pelvic disease the appendix should be examined and removed when abnormal or diseased, unless the patient's condition is such as to forbid an extension of the period of operation. The question of prophylactic removal of a normal appendix during abdominal operations is one that is still under consideration. The author is of the opinion that patients should always be consulted beforehand, and it is his experience that they generally leave the matter to the discretion of the operator. The removal is so simple and quickly carried out that it can scarcely be considered as adding materially to the risk of most abdominal operations. The possibility of diagnosing pelvic for appendiceal disease, or the latter for the former, should also be kept continually in mind. Mistakes may lead to very serious results. Thus, the author has known an acute gangrenous appendicitis treated as an acute salpingitis, palliative treatment being recommended, with the result that rupture occurred, causing death from general peritonitis. In another case a tender swelling in the right half of the pelvis, developing about a year after supravaginal amputation of a myomatous uterus, was regarded as an enlargement of the right appendages, which had not been removed at the time of operation, and a vaginal section was made for the purpose of extirpating the mass; so many adhesions were found that the operation was abandoned and an abdominal incision made. The cecum was found in the pelvis, and the appendix, thickened and containing pus, was adherent to the right broad ligament, the appendages being scarcely affected.

Mistakes are also frequently made which do not endanger the patient's condition, because operative treatment is carried out at the earliest possible opportunity. Thus torsion of the pedicle of an ovarian tumor, producing pain, nausea, vomiting, leukocytosis, etc., may solely simulate an acute appendicitis, and a considerable number of cases are on record. The mistake is most likely to occur when the tumor is small and situated above the pelvic brim, when there was no previous knowledge of its existence, and when the abdominal wall is so rigid and sensitive to palpation that the growth cannot be palpated.

The author has recently seen a case in which the diagnosis of appendicitis was made in a girl of thirteen; there were right-sided pain, dulness and rigidity, elevation of temperature, and increasing leukocytosis. No mass could be felt in the pelvic cavity on rectal examination. At operation there was found torsion of a small left ovarian cystic tumor, with hemorrhage into its substance and necrosis. It was adherent in the right iliac fossa and there was local peritonitis. The appendix was slightly thickened and contained a little pus. The dulness on percussion in the iliac region was due to the tumor, but it was regarded before operation as caused by inflammatory exudate following an appendicitis.

Rupture of an ovarian or tubal abscess with infective contents may lead to symptoms and signs characteristic of appendicitis, and the diagnosis may be established only by abdominal section.

Right-sided ectopic gestation may sometimes be mistaken for appendicitis, *e. g.*, when there is intratubal hemorrhage, tubal abortion, or rupture of the tube into the peritoneum or broad ligament, especially when localized peritonitis occurs. Inflammation of the right ureter may also simulate appendicitis. Within the last three years the author has seen three cases in which abdominal section had been advised for supposed appendicitis (two of the women being pregnant), when careful examination revealed thickening and tenderness of the lower end of the right ureter. There were successive attacks of right-sided pain, accompanied by elevation of temperature and nausea. In the case of the pregnant women the condition gradually disappeared after labor. The other case grew worse, her condition being tuberculous.

Variations in the symptoms associated with appendicitis in relation to menstruation may be misleading. Thus an acute appendicitis developing just before a menstrual period is expected may cause suppression of the flow and may lead to a diagnosis of some pelvic disorder. In a chronic appendicitis there may be an aggravation of symptoms in connection with menstruation, simulating various disorders of the genitalia and it may be quite impossible to distinguish between them.

Examination of the Blood.—In the study of pelvic and abdominal diseases the most careful attention must be given to the analysis of the blood, not only from the point of view of treatment, but with regard to the establishment of diagnosis. The percentage of hemoglobin and the number of red cells must be estimated, and the leukocyte count is of the greatest importance. In some cases the iodophil reaction of the cells or Ehrlich's reaction may be advisable. Curschmann, in 1901, published a large number of observations relating to appendicitis. He showed that when the leukocytes increased in the first few days, remaining increased, a suppurative process is indicated. A number of 25,000 or more, continuing even for a short time, is an almost certain sign of abscess formation. After opening or removing a suppurating area the leukocytosis diminishes. If this is not the case, there is not free drainage or another area of suppuration exists. He states that the temperature is less reliable than the leukocyte count in diagnosing acute abscess formation.

Federman states that the more severe the case, the nearer the onset of the attack is the highest point of the leukocyte curve. In acute appendicitis this is usually on the third day. Leukocytosis continues as long as toxins are produced which stimulate leukocyte production. When there is general infection, the leukocytes are smaller in number. In general peritonitis he considers high leukocytosis a favorable sign. He insists upon frequent examinations to determine the leukocyte curve, which he regards as more valuable than the actual count.

Dutzmann has made a particular study of gynecologic affections. His conclusions are as follows: The leukocyte count is valuable when an exudate exists, in determining suppuration and in establishing an indication for operation. In doubtful cases the iodophil reaction is valuable. In disease of the tubes and ovaries suppuration may often thus be determined. Tuberculous collections cause no leukocytosis; gonorrheal pus leads to only a slight increase.

Large tumors with twisted pedicle or causing irritation of the peritoneum cause marked leukocytosis, though no pus may be present, but in such cases the iodophil reaction of the leukocytes is absent. Continued leukocytosis in sepsis is favorable, whereas a diminution is an unfavorable sign.

In estimating the number of leukocytes the normal variations must be remembered. The influence of pregnancy in producing leukocytosis must also be kept in mind. In uncomplicated cases of tubal pregnancy it is interesting to note that Dutzmann found no leukocytosis. In chronic localized suppurative processes the leukocyte count is of less significance than in the early stages. Longridge points out that a differential count may give valuable information when the quantitative count fails. He says that when the polymorphonuclear leukocytes rise above 80 per cent., even if the total count be low, abscess formation or marked toxemia must be suspected, though he does not regard this sign as infallible. Gulland also insists on the differential count, though stating that it may fail in chronic suppurative conditions. Scott Carmichael says that, for clinical purposes, the total count suffices in the great majority of instances, and that it is only in doubtful cases, especially where the total count does not correspond with the symptoms, that a differential count is necessary. Locke states that the iodophil reaction is the most certain indication of toxemia. In the great majority of localized abscesses he found a positive reaction, which usually disappeared within twenty-four hours after drainage was carried out.

Differential Study of the White Cells.—Very recently different workers have pointed out that valuable information may be obtained from a comparative study of the different white cells in the blood, viz., the phagocytic groups (large mononuclear, transitional, and polymorphonuclear) and the non-phagocytic (small lymphocytes and eosinophils). Holmes states that the number of the former indicate the fighting strength of an organism, while the latter indicate the character of the endurance. He states that a high or increasing leukocytosis, associated with a high or increasing small lymphocyte count, indicates an infection of high or increasing virulence, accompanied by a high or increasing resisting power. When the former is associated with a low or decreasing small lymphocyte count, there is infection of high or increasing virulence accompanied by a low or diminishing resisting power.

A low or decreasing leukocytosis with a high or increasing small lymphocyte count indicates an infection of low or decreasing virulence, accompanied by a high or increasing resisting power. When both counts are low or decreasing, there is evidence of a high or increasing power. When the small lymphocytes are very scanty, the power of reaction is very low. A gradual increase in their number is a favorable sign.

APPENDICITIS AND PREGNANCY.

Within recent years considerable attention has been given to this subject, Mundé, in 1893, being the first to refer to it in America. In 1897 Abrahams collected only 11 cases reported by American authors, and added 4 others observed by himself. Since that time a very considerable number of cases have been reported both in Europe and in America. The disease is more common than is suspected, being undoubtedly often overlooked because the symptoms

and signs in many cases are not sufficiently pronounced to lead to careful investigation or are classed among the various disturbances which are so frequent in the pregnant condition. The great majority of reported cases have been those in which the phenomena have been distinct or alarming. According to Donoghue, 80 per cent. of these have occurred during the first six months of gestation.

So far as is known, pregnancy does not favor the occurrence of primary appendicitis. In cases in which there has been previous inflammation in or around the appendix, pregnancy may increase the liability to an exacerbation. Increased vascular engorgement and constipation may be factors which exert a harmful influence. But the most important element may be mechanic, viz., pressure of the growing uterus on the appendix and cecum or the stretching of adhesions. The latter factor is likely to be most serious when the appendix is adherent to the broad ligament or pelvic viscera, which are considerably displaced upward by the pregnancy.

Several cases have been observed in which a woman has had definite attacks in successive pregnancies. The seriousness of appendicitis is certainly increased by the complication of gestation, especially in suppurative cases, the risk being greater the more advanced the pregnancy. The mortality following perforation, whether operated immediately or not, is very high. In cases in which the periappendiceal suppuration is localized, the danger is far more pronounced than in the nonpregnant state, because spontaneous emptying of the uterus tends to take place. The alteration in the size and position of the uterus which is thereby produced is apt to lead to rupture of adhesions, bursting of the abscess cavity, and general extension of infection. Even when such areas are opened and drained, there is still a much greater risk than in the case of nonpregnant women.

The occurrence of appendicitis soon after labor is in some cases undoubtedly due to mechanic changes in the uterus and adnexa. Under these circumstances an appendix may be stretched, twisted, or even ruptured, and a severe local or generalized infective process may be started and the wall of the uterus may be invaded. Doubtless such an attack is not infrequently diagnosed as "puerperal infection" in the absence of careful bacteriologic examination of the interior of the uterus, and because the symptoms of acute peritoneal infection of appendiceal origin may resemble so closely those following extension from the tube and uterus. Several cases have been reported in which the appendix was the source of infection, supposed to be "puerperal." As regards the influence of appendicitis on the gestation, it is certain that there is no interference in slight cases, or even sometimes in sharp attacks where there is no suppuration. But, generally, in severe disturbances, especially where an abscess or general peritonitis develops, there is a tendency to emptying of the uterus and to fetal death. Infection may extend to the uterus and its contents, or the fetus may be affected by the high temperature and the circulating toxic matter. In some cases, however, in advanced gestation a living fetus is expelled, though it is not likely to survive if the patient has been septic for some time previous to delivery.

Diagnosis.—The diagnosis of appendicitis in pregnancy is sometimes easy, but is often uncertain. When the characteristic typical features of an acute attack occur, they are generally recognized, but in other circumstances it may

be difficult to form an opinion. In slight cases the nausea which may be present is apt to be considered as due to the pregnancy. Pains may be regarded as due to old pelvic inflammation, or, in some cases, to threatening of miscarriage. Leukocytosis may be thought to be due to pregnancy.

Whenever fever occurs with pain in the right side and nausea, the possibility of appendicitis as a cause should be kept in mind. An infective process in the ureter or pelvic organs, gall-bladder, or right kidney, various gastro-intestinal disorders, and other conditions may produce somewhat similar symptoms, and thus an error in diagnosis may easily arise.

A severe sudden attack may simulate rupture of an ectopic gestation, but with the latter there is usually more or less evidence of loss of blood without fever.

When a local abscess forms, the mass may be mistaken for a tumor. In one case observed in consultation by the author the pus extended on one side deeply into the pelvis and displaced the pregnant uterus toward the opposite side, so that it was believed to be an ectopic gestation.

Treatment.—Every nonpregnant woman who is likely to become pregnant, in whom a definite attack of appendicitis has once occurred, should have her appendix removed before pregnancy is allowed to take place, as a prophylactic measure. When the condition is diagnosed for the first time during gestation, or when there is a recurrence of an old attack, it is advisable to operate as early as possible. The earlier in pregnancy the operation is performed, the more satisfactory is the result and the stronger the abdominal wall if the patient goes to full time. There is always a risk of interrupting pregnancy by the operation, and this is probably increased if the latter be prolonged or the viscera be handled excessively. In suppurative cases this risk is very much greater. The most troublesome cases are those in which drainage must be employed, since during healing adhesions are apt to form on the right side of the uterus which may lead to distress or tenderness if pregnancy continues, and may interfere with the action of the uterus during labor. Moreover, the scar area may be weakened and herniation may occur. If premature emptying of the uterus takes place during drainage, there is a risk of infection of the genital tract by the discharge. When general peritonitis is present, the outlook is very serious. Free drainage is necessary, but is difficult to carry out satisfactorily if pregnancy be at all advanced.

In all acute cases in advanced pregnancy Marx advises *accouchement forcé* at first, followed by the abdominal operation. This suggestion is a good one, because it enables the abdominal drainage, which may be necessary, to be more thoroughly carried out. It would not be advisable to adopt this procedure in cases in which a localized abscess is present, because of the risk of rupturing the latter by the change in size and position of the uterus, which may form part of its wall.

When an attack of appendicitis occurs during labor, operative interference should be carried out very soon after delivery. An abdominal operation should also be performed when the disease develops in the puerperium.

The method of incision generally favored is McBurney's. The technic is that ordinarily employed in nonpregnant cases.

CHAPTER XXIII.

ENTEROPTOSIS.

Since the publication of Glénard's work in 1885, in which attention was directed to displacement of the abdominal viscera (enteroptosis) as a cause of the neurasthenic condition, numerous observations have been made corroborative of many of the statements of the French writer. While there is a consensus of opinion among prominent clinicians as to the importance of enter-

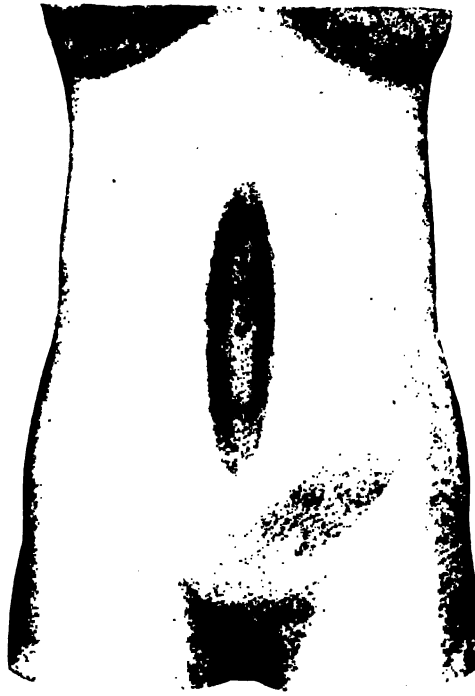


Fig. 357.—Median grooving of the abdominal wall where there is separation of the recti abdominis muscles. The woman is represented as lying on her back.

optosis in producing disturbances of health, there are numerous divergent views as to the etiology of the condition and as to the relative value of the various factors concerned in its production.

Several authors regard the condition as a reversion to the embryonic type, since in cases of advanced enteroptosis the position of the abdominal viscera closely resembles that found in the embryo. Some believe that in some in-

stances there is a hereditary predisposition, the tissues being exceptionally weak. Keith thinks that the visceral displacements are to be related to disturbances in the normal method of respiration. Chlorosis and various exhausting diseases are believed by several to lead to weakness in the visceral ligaments, which may result in permanent stretching and enteroptosis.

There is a wide-spread consensus of opinion as to the etiologic importance of mechanic constriction of the waist by corsets, belts, and skirt-bands, and to the weakening of the abdominal wall resulting from the distention of pregnancy and other conditions.

Thomas R. Brown classifies the various theories in the following groups:

1. The condition is congenital, being due to an inherent weakness of the visceral supports; other factors, such as trauma, waist-constriction, disease, etc., being merely contributory causes, making evident and accentuating the inherited tendency.

2. The condition is due to causes which weaken the visceral supports by pressure, trauma, adhesions, relaxation of the abdominal wall, such as pressure of clothing, injury, pregnancy and labor, abdominal tumors, various spinal and thoracic diseases, weakness of abdominal wall, etc.

Brown believes that each of these groups explains the various cases of enteroptosis which occur; in other words, that there may be both congenital and acquired forms.

The nature of the normal relationships of the abdominal and pelvic contents and the methods by which they are altered is a somewhat complicated problem, involving a consideration of anatomic, physiologic, and physical factors which are not yet thoroughly understood.

It is not my purpose to refer to these in detail, but rather to direct attention particularly to one factor, viz., the abdominal wall. This structure, composed of a variety of tissues, the most important of which are the fascial and muscular layers, normally exhibits a certain degree of tonicity helping to maintain the position of the trunk and to exert pressure on the abdominal contents. The latter function it shares with the diaphragm and pelvic floor.

The average specific gravity of the viscera and contents is very little more



Fig. 358.—Median abdominal bulging produced as the result of an effort on the part of the woman (represented in Fig. 357) to rise from the table.

than that of water—the liver, for example, is about 1.05 specific gravity—and it is customary to regard the visceral mass as a body of water, so far as the physics of the abdomen is concerned. This being the case, it is evident that the pressure at the surface is distributed at right angles to the latter in all directions.

In addition, the influence of the weight of the mass has to be considered. This varies according to the position of the individual. In the erect posture it causes a slight bulging of the lower part of the abdominal wall and the pelvic floor is slightly lowered. If the position be altered so that the pelvis is higher

than the thorax, the bulging of the lower abdominal region and pelvic floor is lessened, while near the thorax the abdominal wall is pushed slightly forward.

Schwerdt has endeavored to calculate the intra-abdominal pressure experimentally. He measured it within the stomach in the erect posture by means of a water manometer, and found it to be 11 cm. In the rectum it measured 39 cm. The difference of 28 cm. represents the weight of the viscera supported by the pelvic floor. The vertical distance between the diaphragm and the pelvic floor was 36 cm., and it was, therefore, evident that the pelvic floor did not sustain the whole weight of the viscera. At first sight it might appear that the difference of 8 cm. represented the support given to various viscera by their ligamentous attachments, and this might seem to be all the more probable when it is remembered that the specific gravity of the viscera is



Fig. 359.—Pendulous belly (enteroptosis). There was marked separation of the recti abdominis muscles. The illustration represents the condition in the erect posture.

very little more than that of water. Were the comparison to free fluid absolutely correct, the water manometer placed in the rectum would register the weight of the whole column of 36 cm. of water.

Are we then to conclude that the difference of 8 cm. is due to ligamentous support of the viscera? Certainly not, because the stomach and intestines contain air and gases, and the specific gravity of the whole column extending from diaphragm to pelvic floor must, therefore, be less than that of water. Schwerdt calculates that the proportion of the weight of the viscera supported by the ligaments is one-eighth, but it is likely that this is too high an estimate, and several workers think it doubtful if, under ordinary circumstances, the



Fig. 360.—Pendulous belly (enteroptosis) associated with marked separation of the recti abdominis muscles. Anterior aspect. Erect posture.



Fig. 361.—Pendulous belly (enteroptosis) associated with marked separation of the recti abdominis muscles. Profile view. Erect posture.

ligaments act as supports at all. Symington has shown that normally the suspensory ligament of the liver is not tense, and Buist points out that this organ, whose greatest vertical diameter is 8 cm., must easily be supported by the subjacent viscera, since Schwerdt's experiment shows that the manometer registers in the stomach a pressure of 11 cm. So it is with the intestines. There is no proof that, under normal conditions, their mesenteric attachments act as constant supports or are ever meant to be such. Their structure is not of the consistence to make them efficacious for this purpose. Indeed, whenever pathologic conditions are introduced which put continued strain on the ligaments, they always prove to be unfit for the work thrown upon them and undergo gradual elongation. This being the case, it is evident that the important fac-



Fig. 362.—Pendulous belly (enteroptosis) associated with marked separation of recti abdominis muscles. Patient is lying on her back. The lax, wrinkled anterior abdominal wall is shown.

tors in sustaining the viscera in their normal relationships are the abdominal wall and pelvic floor.

Normally, there are variations in the intra-abdominal pressure, depending on different conditions, mainly on the state of fascial and muscular structures in the parietes. The stronger these tissues, the more is the resistance offered to the pressure of the viscera and the better the latter are supported.

The importance of the pelvic floor has long been recognized. The various hernial developments associated with weakness or laceration of different parts of its structure have been well investigated and many measures have been devised by gynecologists for the relief of the symptoms accompanying these conditions.

The other factor, the abdominal wall, has received very little attention. Several writers, Prochnowik, Landau, Tuffier, Fritz, and others have referred

to it, but their writings have received little notice. Recently, Wolkow and Delitzin have drawn attention to the importance of the abdominal wall, anatomically and physiologically, in giving support to the abdominal viscera. They have experimented on the cadaver, weakening the wall by removal of one or the other of its component parts, and thus bringing about descent of various viscera.

There is a difference of opinion as to the relative values of the fascial and muscular structures. Stanmore Bishop, for instance, urges the prime import-



Fig. 363.—From drawing of cast of abdomen in a case of marked separation of the recti abdominis muscles.

ance of the fasciæ, and, speaking of the anterior part of the wall, he states that the recti muscles are of comparatively little value as a source of strength. From the experiments of Wolkow and Delitzin, however, it would appear that these muscles are of considerable importance, their removal being followed by a stretching of the linea alba and a bulging due to descent of the viscera.

When one considers the effect of certain physical exercises in strengthening and thickening the abdominal wall it is easy to understand the importance of the musculature.

Weakness of the abdominal wall following muscular atrophy from dress-pressure and disuse is an additional corroboration.

The effects of local weakness in the abdominal wall have been fully described in surgical works under the various forms of hernia. General weakness of the wall has been known as "lax abdominal wall" and "pendulous belly," but there has been no detailed study of the latter conditions.

From my investigations I am convinced that three forms of lax or weak abdominal wall must be recognized:

(1) That due to stretching and thinning of the fasciæ and muscles, without separation of the recti muscles.

(2) That due to stretching and thinning of the fasciæ and muscles, with separation of the recti.



Fig. 364.—Patient with marked separation of the recti. The photograph from which this illustration was made was taken as the upper part of the body was being raised from the table. The physician's fist is buried in the gap between the muscles, which are contracting. In this case there was pronounced pendulous belly. As the patient lay relaxed on her back, the distance between the muscles at the level of the umbilicus measured five and one-half inches.

(3) That due to separation of the recti muscles caused by stretching of the common fascia (linea alba) between them.

All cases of marked pendulous belly belong either to group (2) or group (3). My observations prove also that these groups are frequently found in moderate degree, associated with various forms of enteroptosis, which may directly result from the altered condition of the abdominal wall or may be aggravated if it has already been in existence.

The importance of separation of the recti has been overlooked by most writers on the subject of enteroptosis. Many variations are found in the extent to which it is developed. In the least marked cases it is recognizable usually only in the region of the umbilicus. In more marked stages

the area affected may extend an inch or more above the navel and a similar distance below, though rarely the part above or that below may be affected. In the most advanced conditions the diastasis extends from the pubes to near the ensiform cartilage.

The more marked the case, the more thinned is the linea alba; sometimes it is so stretched that it is impossible to dissect any extensive portion of it as a distinct layer. The fact that the stretching in its earliest stages is generally



Fig. 365.—Abdomen of woman with separation of recti abdominis muscles and following the removal of a large abdominal tumor. The drawing was made as the patient lay on her back.

found at the umbilicus is evidence that this point is the weakest in the middle line of the abdominal wall.

As a result of stretching of the linea alba separation of the recti muscles takes place. In extreme degrees of the affection the recti may be separated in the middle region of the belly as much as five or six inches, the intervening portion of the wall being bulged by the enteroptosed viscera.

Etiology.—In almost all cases the diastasis is found in women who have borne children. The most marked examples occur in those who have gone through several labors, though they may be found in those who have had only

one or two children. Indeed, the examination of the abdomen of primigravidas in a large number of maternity cases has convinced me that in the great majority of women there is some degree of separation of the recti in the region of the navel as a result of the distention of pregnancy. After labor, in many instances, however, owing to retractility of the abdominal wall, all evidence of stretching may disappear, though in a considerable proportion of cases permanent widening remains, which is likely to become increased in succeeding pregnancies.

All conditions increasing intra-abdominal pressure in pregnancy tend to favor the development of the diastasis. Thus, women who work hard in the second half of pregnancy, especially those who lift or carry heavy weights, are more apt to become affected. Sometimes a sudden strain or fall is the starting-point of the condition. Among all classes the wearing of corsets in pregnancy is not infrequently an important associated cause. It is very easy to understand how this should act detrimentally. The intra-abdominal space being artificially constricted above and being gradually encroached on by the growing uterus from below, the various viscera are more and more compressed into the intermediate area, where the weakest and least resistant portion of the abdominal wall is at the umbilicus. In all women flatulence and constipation, abundant adipose tissue in the mesentery and omentum must be regarded as favoring causes. So also is any condition which induces excessive coughing in pregnancy. General weakness or emaciation also predisposes, by lowering the tone of the tissues of the abdominal wall.

Of equal and perhaps greater importance is the effect of these conditions after delivery. In this period perhaps the two most important factors concerned are tight lacing in one class of women and too early hard work in another. A certain degree of diastasis having been established as a result of pregnancy, it is easy to understand how increased intra-abdominal pressure resumed after labor may lead to a continuance or intensification of the parturient weakness.

In nulliparous women slight degrees of stretching of the linea alba are occasionally found, marked degrees rarely. I have never met an extreme case.

It is thus evident that of all the factors which may be associated with the development of this condition in women, pregnancy is the most important. Occasionally cases are found in which the chief cause is distention due to tumors or ascites.

Results.—The inevitable result of marked or continued stretching of the linea alba is enteroptosis. This is met in different forms and degrees, considerable variations existing as regards the order and range of descent of the viscera.

In cases in which the diastasis is only slightly or moderately developed, the variations are most marked. These, I believe, depend largely on the mode of life and dress. Thus, in some cases, no descent of any of the viscera can be made out. These are almost always women who have not been accustomed to wear corsets, tie the skirts tightly around the waist, or engage in heavy or vigorous exercise. In those women with slight or moderate diastasis, whose mode of dress or work leads to increased intra-abdominal pressure, the visceral displacement most frequently found is prolapse of the right kidney. In such cases it is very difficult to estimate the frequency of descent of other viscera, especially the hollow ones, by physical examination of the abdomen.

In a number of cases in which I have performed abdominal section for pelvic troubles I have found the transverse colon and, sometimes, the stomach lower than normal, whereas by external examination I had been previously able only to distinguish prolapse of the right kidney.

Where marked stretching of the linea alba takes place, descent of the viscera and elongation of their attachments occur. In the most extreme degrees the belly is very protuberant and pendulous, the projecting portion being filled with small intestines, omentum, transverse colon, and, sometimes, the stomach. Great variations are found as regards the extent to which the viscera are prolapsed. Alterations in the shape and position of the liver



Fig. 366.—Patient with marked separation of the recti. The illustration represents the marked bulging between the recti as the head and chest are raised from the table, the abdominal muscles being thus made to contract.

are probably, as Hertz has shown, chiefly related to the influence of corset-constriction.

Downward displacement of the right kidney is frequently found, the left organ being much less often affected, and to a less degree. The spleen is occasionally dislocated.

The abdominal wall between the recti usually becomes thinned. The recti themselves are pushed laterally as the linea alba is stretched, and extend in a curved line from sternum to pubes, the convexity reaching well out into the lumbar region.

Prolapse of one or other part of the pelvic floor is frequently met. This is mostly found where the floor has been injured in labor. It is very easy to understand why this complication should be brought about as a result of enter-

optosis. Retroversion of the uterus, with or without prolapse of the floor, is also often found.

Symptoms.—The symptoms vary greatly. They are those which have been described in recent literature in connection with enteroptosis. In severe cases the patient may complain of weakness and dragging in the back and abdomen, aggravated on long standing, walking, or working. The bowels are

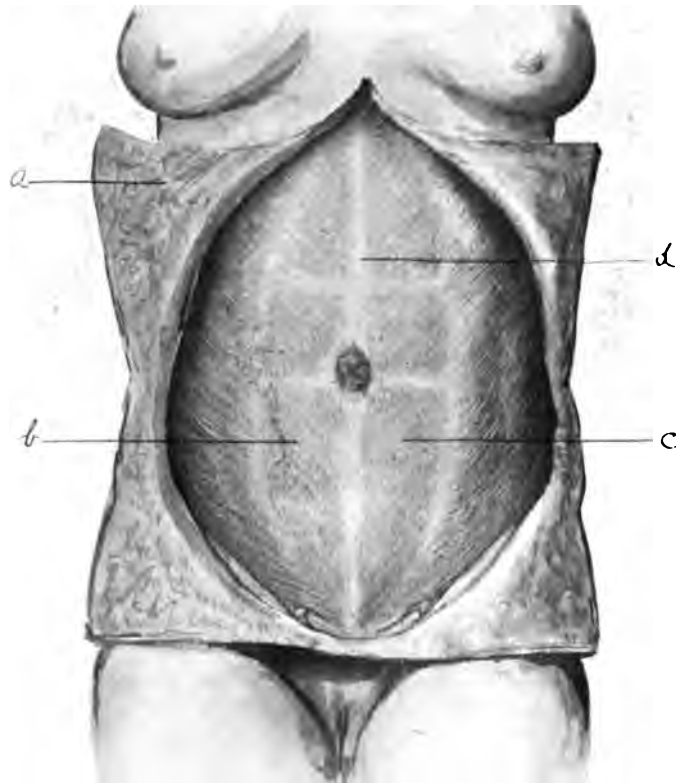


Fig. 367. —Dissection of anterior abdominal wall in a multipara, with diastasis of the recti muscles: *a*, Inner edge of right rectus; *b*, inner edge of left rectus; *c*, linea alba stretched and thinned.

usually sluggish. Pains may be felt in the iliac, lumbar, or other regions. Various dyspeptic symptoms may be present. Pulsation of the aorta may disturb the patient. Nausea and vomiting may be distressing. The patient often loses weight, and a neurasthenic state is frequently induced. Not even in the most marked cases are these symptoms always present. Often some are absent and, in many instances, one complaint is prominent above all others.

When the linea alba is not much stretched, there may or may not be symptoms. In this class they are very rarely absent, in some degree in those who constrict the abdomen by their dress, stand long, or engage in heavy work. Frequently in such cases the chief cause of distress is marked downward displacement of the kidney. Patients of a nervous temperament are most easily affected. Of all the symptoms, those which I have found most constant are weakness and dragging in the abdomen and back, aggravated by long standing or exertion.

Diagnosis.—The diagnosis of diastasis of the recti is easy. The patient should be made to lie flat on her back and the abdomen palpated in the following manner: The physician places the finger-tips of his right hand on the middle line of the abdomen near the navel. His left hand grasps the patient's hands and she is asked to raise her head and chest somewhat from the table, in order to contract the recti muscles. As the muscles shorten they tend to approach the middle line. In this way the physician gages the extent of their separation, thus determining the degree to which the linea alba is stretched.

In many cases in which the condition is marked this procedure is not necessary. As the patient lies relaxed, the edge of the separated muscles may be easily palpated. The vertebræ may be felt with great ease, especially in thin women, and pulsation of the aorta is often visible.

Often a distinct groove may be noticed along the middle line of the abdomen, and when the patient contracts the abdominal muscles, this part of the wall bulges forward. Frequently, palpation between the recti causes a feeling

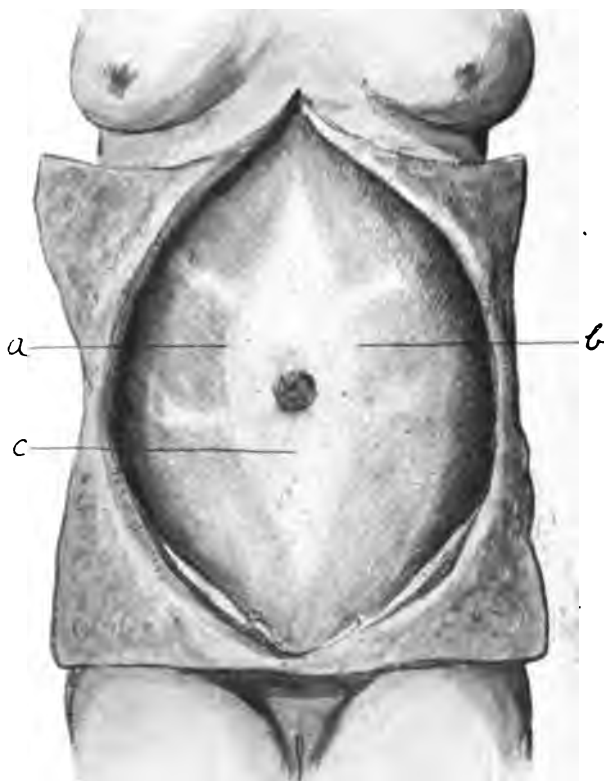


Fig. 368.—Dissection of anterior abdominal wall in a nullipara. The normal relationships are shown: *a*, Skin turned aside; *b*, *c*, recti abdominis muscles seen through their anterior sheath layers; *d*, linea alba.

of soreness which the patient states to be similar to that which she feels while walking or working.

In the most extreme cases in which the recti muscles are pushed far out palpation of the lumbar regions may lead the physician to think that he is feeling a prolapsed kidney or some other swelling. In my clinic this error is frequently made by students. The mass which is felt is mainly made up of an abnormally placed rectus muscle.

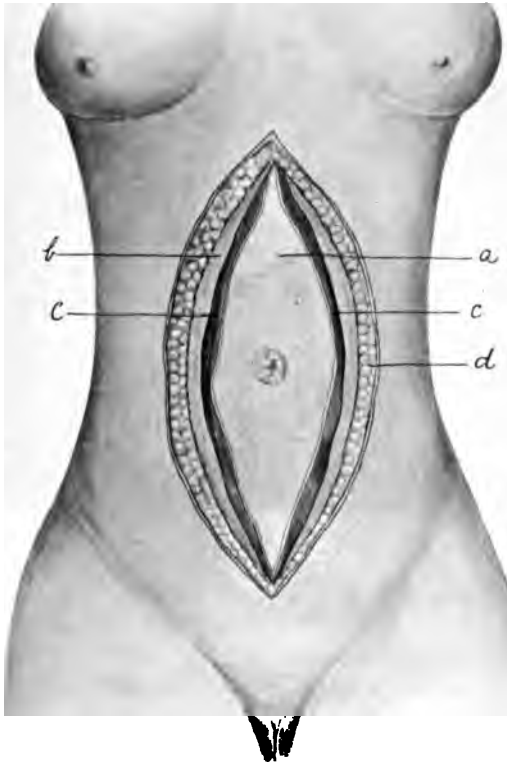


Fig. 369.—Operation for repair of weakened abdominal wall. The drawing represents the inner edges of the separated recti muscles exposed: *a*, Stretched and thinned linea alba; *b*, anterior layer of sheath of rectus; *c*, edge of rectus muscle exposed by opening sheath; *d*, skin and subcutaneous tissue.

In extreme cases associated with great descent of the intestines the lower portion of the abdomen bulges markedly when the patient sits or stands.

Treatment.—In every case the patient should be advised to give up the corset and suspend the skirts from a loose waist or from the shoulders. This procedure is sufficient to relieve all symptoms in many cases in which the trouble is not very marked, even though there be considerable displacement of the right kidney. When there has been atrophy of muscles constricted by the corset and tight skirt-bands, a course of massage to improve the affected parts should be recommended. This may be profitably combined with moderate gymnastic exercises calculated to bring these muscles into action.

In marked cases the above treatment may often give some degree of relief as long as the woman avoids

every form of exertion tending to increase the intra-abdominal pressure. But as it is impossible to be assured of this avoidance in the majority of women, it is best to have recourse to other measures.

First, the patient may, in addition to the adjustment of her clothing as above described, wear continually a broad silk-elastic abdominal binder. Such a mechanic substitute for the normal abdominal wall, by supporting the viscera, often gives great relief.

This method of treatment is open to the following objections: The binder must be worn continually, resulting inevitably in atrophy and weakening of many of the trunk-muscles. It is often unpleasant to the wearer, especially in hot weather. It has to be renewed at intervals of a few months, a serious consideration for a poor woman. It is least effective and most quickly gets worn when the patient engages in daily work.

For these reasons I have introduced the following surgical procedure as a means of restoring the abdominal wall to a more satisfactory condition.

An incision is made in the middle line of the abdomen, dividing the skin and subcutaneous fat until the linea alba is reached. Its length varies according to the extent of the separation of the recti. In very bad cases it may extend from the symphysis nearly to the ensiform cartilage. The umbilicus



Fig. 370.—Abdomen of patient after operative repair of marked separation of the recti. The wall is considerably reduced in size and the bulging much less prominent.

should be entirely removed if it be deep and difficult to clean thoroughly. Otherwise the mesial incision may be carried on one side of it. When the linea alba is exposed, the skin and fat should be dissected off the fascia on both sides of the middle line until the edge of each rectus is reached. The sheath of each muscle should then be entered at its inner border, near the lower angle of the wound, and this incision should be carried along the edge of the muscle as far as is necessary, the anterior layer of the sheath being divided where it becomes the stretched linea alba. The muscles are then loosened from their internal attachments to the sheath. When the muscles are thinned, they should be pushed somewhat outward in their sheaths. Some of the redundant anterior sheath layer on one side may be removed, the opposite one being made to overlap when approximation of the muscles is brought about. In marked cases it is advisable to constrict the fascia external to the peritoneum from side to

side by a continuous catgut suture in one or more layers. I have employed two methods of suturing. In my first sixty cases the following plan was adopted: A series of sutures were first passed from side to side through each muscle and its corresponding anterior sheath layer. When these were tied, the muscles were in apposition close to the middle line covered by the fascia. As suture material, I always used strong linen prepared by a modification of

Gubaroff's method. It was left permanently buried. Careful apposition of the fascial edges was made with catgut. The edges of the incision through the skin and superficial fascia and fat were then closed.

This is often followed by a bulging of the skin along the line of the incision in cases in which separation of the recti has been very marked, and is an evidence of the reduction in size of the abdominal wall due to approximation of the muscles. Owing to retraction in the tissues, the bulging of the skin afterward disappears. In marked cases I have removed a strip of skin and fat from each edge of the wound before closure, in order to diminish the bulging. In my recent cases (about forty) I have closed the wall with strong linen, silk, or silkworm-gut sutures passed through skin, fasciæ, and muscles (see p. 236). Before these are tied, the fascial edges anterior to the recti are approximated with formalin catgut; the sutures are not removed until the

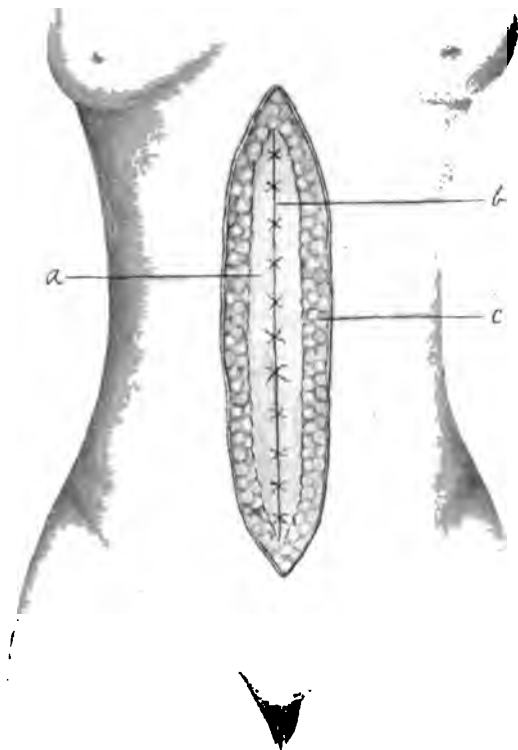


Fig. 371.— Operation for repair of weakened abdominal wall. The drawing represents the recti muscles with the fascia covering them drawn together and sutured by strong linen: *a*, Fascia forming anterior sheath layer of rectus; *b*, line of junction of the muscles and sheaths; *c*, skin and subcutaneous tissue.

sixteenth day. The results have been satisfactory with both methods. Three cases of stitch infection occurred before the patients left hospital, two of which were those in which linen had been buried. In each case the infected area was small and localized. One of these developed a small hernia in the course of eighteen months.

This operation was first performed by me in November, 1898, in the Royal

Victoria Hospital, Montreal, and since that time increasing experience has impressed upon me the efficacy of the procedure.

In nearly every case there has been more or less downward displacement of the right kidney; the left kidney has been rarely palpable, and only in very few instances has it been markedly displaced. In about 8 per cent. of these dislocations, where the organ descended very low, I have performed nephrorrhaphy. In 60 per cent. of the cases retroversion or prolapse of the uterus has been present and has been treated by operative measures.

Downward dislocation of the stomach and transverse colon has been usually present. Only in two or three cases was the liver noticed to be lower than normal and only to a moderate extent.

The operation has almost always been followed by improvement, usually marked in character. Patients who have been much run down and neurasthenic have generally recovered health very slowly.

In several women in whom the right kidney was considerably dislocated, nephrorrhaphy was not carried out, in order that the repair of the abdominal wall might be tested as to its value in supporting the viscera. I asked all of these to write to me if symptoms developed which might possibly be connected with the kidney. Only two have communicated with me, complaining of distressing dragging in the back, and have desired to have the right kidney fixed by operation.

I urge all who undergo the repair operation to abandon corsets and support their skirts from the shoulders. Particularly are they enjoined to avoid all severe or sudden exertion for at least six months. During the early weeks of convalescence daily massage of the abdominal parietes is advisable. Afterward, light gymnastic exercises, calculated to improve the abdominal muscles, may be carried out.

In cases where the enteroptosis has been marked, the patient should wear a broad, silk-elastic binder for six or eight months after operation.

CHAPTER XXIV.

STERILITY IN THE FEMALE.

Pregnancy should not be allowed until a year has elapsed.

Sterility means lack of the power of reproduction. The term is used, however, in reference to two classes of cases, viz., absolute and relative.

Absolute sterility is the condition in which there is permanent failure of the reproductive function, *e. g.*, owing to disease, congenital defect, or absence of organs or removal by operation.

Relative sterility refers to a variety of conditions. Thus it may be used to describe cases in which, after marriage, there is a long interval before the birth of a child, providing that means have not been adopted for the prevention of conception; also, those in which, after one child is born, there is a long interval before the birth of another. Some authors also include the cases in which, though conception may occur, there is abortion, premature labor, or the birth of a nonviable child.

Etiology.—Reproduction implies the transmission of an ovum through the Fallopian tube to the uterus, fertilization of the ovum by spermatozoa transmitted through the genital tract, and embedding and growth of the fertilized ovum in the uterine mucosa. Sterility may be due to faults connected with any of these processes:

1. **Faults in the Ovaries.**—(1) *Rudimentary condition or absence of both*, whether the latter be congenital or caused by operation.

(2) *Prolapse.*—Extreme downward displacement of the ovaries may in some cases make it impossible for the expelled ova to reach the tubes before they are destroyed in the peritoneal cavity.

(3) *Inflammation.*—Ovaritis may lead to great destruction of the Graafian follicles with their contained ova. It may cause such sclerosis of the inter-follicular tissue as to prevent escape of the ova to the surface.

Peri-ovaritic adhesions may either prevent dehiscence of the ova or their passage to the Fallopian tube.

(4) *New-growths*, cystic and solid, tend to destroy the ovum-producing power, partially or entirely. Sterility is, therefore, most apt to be caused when both ovaries are affected, but the presence of a neoplasm in one may often interfere with the transmission of ova from the other ovary to the tube, probably by some mechanic interference.

2. **Faults in the Fallopian Tubes.**—In the great majority of cases it is believed that the spermatozoa and ovum meet in the tube; consequently faults in the latter may cause sterility by interfering either with the male or the female element.

(1) *Absence*, whether congenital or caused by operation. It is to be noted that several cases have been reported in which, after removal, pregnancy has occurred. This is due to reopening of a stump left attached to the uterus.

Double ligation and division of the tube may not insure sterility, for the uterine end may again become patent.

(2) *Inflammation*.—Closure or narrowing of any part of the tube by inflammation interferes with the passage of ovum or spermatozoa. Thickenings of the wall or perisalpingitic adhesions have the same effect. Moreover, the secretion in the lumen in infective conditions may have a destructive influence on ovum and spermatozoa.

(3) *New-growths* are rare, but may cause sterility by interfering with the permeability of the tube.

(4) *Dislocation and bending*, such as may sometimes be found with a retroflexed and prolapsed uterus, may sometimes cause sterility.

3. **Faults in the Uterus.**—(1) *Defective development or absence*.

(2) *Conic cervix*.

(3) *Stenosis of the os*.

(4) *Displacements*.—Prolapse, retrodeviations, and anteflexions are frequently associated with sterility, but the relationship is not always evident. An abnormal flexion of the uterus may interfere with the passage of ovum or spermatozoa, but in many cases it is probably an associated inflammatory change in the uterine mucosa of the tubes and ovaries which may cause the sterility. Sometimes the important factor may be a kinking of the tube.

(5) *Superinvolution* following pregnancy is a well-recognized cause.

(6) *Subinvolution* is also frequently a cause, especially if associated with inflammation. If pregnancy does occur in this condition, abortion is apt to take place.

(7) *Inflammation*.—Inflammatory changes, whether in the cervix or body, are frequently associated with sterility, especially when due to the gonococcus. Whether the discharge destroys the spermatozoa or ovum or whether the altered condition of the mucosa interferes with embedding of the ovum is not known with certainty. In many cases the sterility is due to diseased conditions of tubes or ovaries.

(8) *New-growths*.—Neoplasms are very frequently associated with sterility, but are not an absolute cause. Thus, conception may occur with almost every variety of fibroid. The explanation of the sterility is not always certain. In many instances it is due to associated lesions in the adnexa. The passage of the ovum from the tubes may be interfered with, or the spermatozoa may not be able to move upward in the uterus. Malignant disease absolutely prevents conception except in the very early stage. If pregnancy does take place in a uterus with tumors, there is a great risk of premature emptying of the organ or of complications which necessitate interference.

4. **Faults in the Lower Genital Tract.**—

(1) *Malformations*, e. g., absence or atresia of some part of the canal or an abnormally short vagina.

(2) *Trauma*.—Stenosis of the vagina following injury in labor, operative procedures, or the use of caustics or scalding water may cause sterility, though not in all cases. When fistulous communications with the bowel or bladder take place, conception is usually prevented.

Extensive tears associated with marked gaping of the vulvar orifice or prolapse of the vaginal walls may lead to sterility in some cases, because the semen is not retained after intercourse.

(3) *Inflammatory changes* may produce discharges which destroy the spermatozoa, or they may cause dyspareunia, which prevents satisfactory coitus and reception of the semen. They may also cause atresia.

(4) *Neoplasms*.—These may mechanically prevent the ascent of the spermatozoa, or the latter may be destroyed by a discharge caused by the growths; in some cases coitus may be interfered with by the bulk of the tumor or by the discomfort caused by it.

Other Causes.—Regarding the conditions which affect the vitality of the ovum and spermatozoa and which influence their conjugation, very little is known. Indeed, the entire question of fertility in the human species is one which requires elucidation. The great difficulty lies in the collection of accurate data. The influence of such conditions as climate, temperature, and consanguinity in marriage has often been reported, but not satisfactorily demonstrated. Want of sexual agreement as a factor is little more than a speculative fancy.

Chronic wasting diseases, anemia, and adiposity are undoubtedly frequently associated with sterility. Many infectious diseases may be followed by sterility, but their mode of action is not always certain, though in some cases destructive changes in the ovaries are brought about. They may also lead to atrophic changes in the internal genitalia.

Von Grünewaldt has made a study of a large number of cases of sterility for the purpose of determining the relative importance of conception and gestation, and concludes that interference with the latter is more important than is generally believed. He states that conception is of slight importance as compared with the large number of vital processes concerned in gestation; the most important factor in fertility is the capability of carrying a fertilized ovum, which depends to a great extent on the condition of the uterine mucosa.

In investigating sterility, the male factor must always be kept in mind. Gross' investigations showed that it is the cause in one case in every six. Not infrequently a woman is blamed or subjected to unnecessary treatment when the fault lies with the husband.

Treatment.—The treatment of sterility in the female need not be specified in detail, for it embraces a great range of procedures calculated to improve either the general health or the condition of the genital tract. From a review of the pelvic disturbances which have been mentioned it is evident that a considerable number of operative procedures, major and minor, may be included. It is also clear that in many cases the condition of sterility cannot be altered.

The practice of artificial insemination, recommended by some, is one that has met with very little success. Moreover, it is revolting and not likely to be widely employed.

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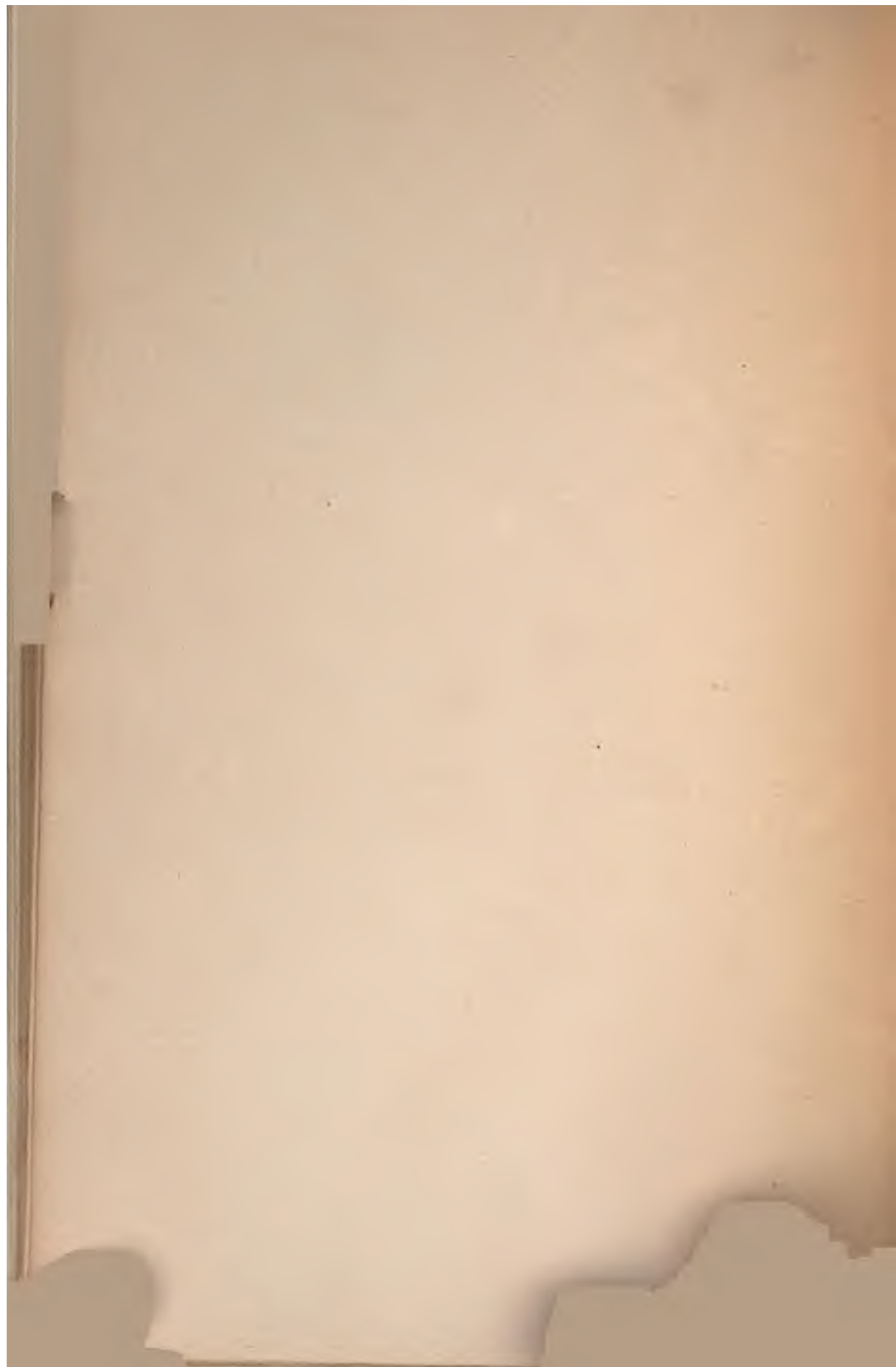
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